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# Practical Dry Cleaner Scourer and Garment Dyer

*Comprising*

Dry, Chemical or French Cleaning; Purification of Benzine;  
Removal of Stains or Spotting; Wet Cleaning, Including  
the Cleaning of Palm Beach Suits and Other Summer Fab-  
rics; Finishing Cleaned Fabrics; Cleaning and Dye-  
ing Furs, Skin Rugs and Mats; Cleaning and Dye-  
ing Feathers; Cleaning and Renovating Felt, Straw  
and Panama Hats; Bleaching and Dyeing Straw  
and Straw Hats; Cleaning and Dyeing Gloves;  
Garment Dyeing; Stripping Colors from Gar-  
ments and Fabrics; Analysis of Textile  
Fabrics; Practical Chemistry for the  
Cleaner and Dyer

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SIXTH CORRECTED EDITION

ILLUSTRATED BY FORTY-ONE ENGRAVINGS

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## PREFACE TO THE FIFTH EDITION.

DURING the past several years the cleaning and dyeing industry has experienced a wonderful growth. Many new plants have been constructed throughout the country, and many of the older plants remodeled, enlarged and re-equipped to take care of the growing demands for cleaning and dyeing service.

This growth was healthy and natural and will most likely continue. It has been due, in the main, to an expanding realization on the part of the public that the cleaning and dyeing plant is an important factor in the scheme of present-day living and that by the aid of the cleaner and dyer one is able to present a neat appearance at all times at a small cost. The growth of the industry will continue as this knowledge spreads and as more people learn and appreciate that the cleaning plant is an aid to thrift and better health through its ability to keep the outer garments clean and in a sanitary condition.

Improvements in equipment and methods have kept pace with the growth of the industry. New processes and machinery are continually being designed to improve the quality of the work, decrease the cost and render to the public a better quality of service. These facts were kept in mind when preparing the fifth edition of *Practical Dry Cleaner, Scourer and Garment Dyer* for presentation to the industry. All obsolete matter has been eliminated, each chapter has been thoroughly re-

vised and has had such new matter added to it as was necessary to bring the book up to date and give to its readers the latest and best practices for doing the different processes of cleaning and dyeing. One new chapter on "Practical Chemistry for the Cleaner and Dyer" has also been added, which, it is believed, will materially increase the book's interest and value.

In revising the book the chapters on spotting, dry cleaning, wet cleaning and garment dyeing especially received consideration. Those sections dealing with dyeing were completely revised and consideration was given only to dyes of American manufacture. This was necessary because of the fact that very few foreign-made dyes are available in this country at this time.

The writer especially desires to acknowledge, with full appreciation, the valuable assistance rendered to him by Josef Lobel, expert garment dyer, in revising those sections of the book dealing with the dyeing of garments, hats, gloves, feathers and furs.

J. B. GRAY.

CHICAGO, ILL., March 21, 1919.

## PREFACE TO THE SIXTH EDITION

The continued popularity of the *Practical Dry Cleaner, Scourer and Garment Dyer* has exhausted the fifth edition, and necessitated the preparation of a new edition of the book. Numerous changes and corrections have been made throughout the text, wherever it has been found necessary. It is hoped that the new edition will fully maintain the claim to the favor that the work has so long enjoyed as a practical and intelligible guide to the cleaner and dyer.

THE PUBLISHERS.

March, 1929.

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# PRACTICAL DRY CLEANER, SCOURER AND GARMENT DYER.

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## I.

### DRY, CHEMICAL, OR FRENCH CLEANING.

IN 1866, a Frenchman, M. Judlin, laid the foundation of an entirely new industry by discovering the detergent powers of benzine; and this process of cleaning, which is variously known as dry, chemical, and French dry cleaning, has now spread over the entire civilized world. It appears that a method of dry cleaning was known as early as 1848. However, the solvent used was not benzine but camphene, an oil of turpentine specially distilled for burning in lamps.

The success of the method introduced by M. Judlin was due to the fact that it altered neither the fit nor the fashion of the garments, while wet washing with soap not uncommonly affects one or both of them, so that other processes are often required after wet washing, which are seldom necessary with dry cleaning. The dry cleaning of garments is thus simple and rapid, and what is more, most of the benzine used can be recovered for use again.



## 2 DRY CLEANER, SCOURER, GARMENT DYER.

Chemical cleaning does much toward the bettering of social conditions, and to-day the celebrated remark of Liebig that the 'civilization of a nation could be measured by the amount of soap it consumes,' might be supplemented by adding that those countries in which the chemical cleaning establishments are not well patronized, are by far less cultured than those which have recognized the worth and value of this industry.

The full significance of chemical cleaning is steadily gaining ground, and it is becoming more and more a matter of necessity to have such garments as cannot well be laundered thoroughly dry-cleaned from time to time. However, the closeness of the connection between the two cleaning trades is clearly shown by the fact that in many cases the same article has to be subjected to both the processes which form the ground work of the respective methods. Hence, the growing tendency to combine the two methods under the same roof, especially as a steam laundry can add dry cleaning to its business without any considerable further use of capital or space. Power is already at hand, ironing and drying rooms also, and it is merely a question of extending facilities already possessed, and of employing persons skilled in dry cleaning. There can be no doubt about the tendency of the times, and technical education should take the form of training persons competent to do either dry or wet cleaning, as may be required. It is irrational that if, as so often happens, an article requires to be both dry-cleaned and wet-cleaned that it should have

to go to a different establishment to undergo the second process. From the customer's point of view it would surely be an advantage to him if he could send all his articles to one and the same firm, with perfect confidence that the firm has every modern cleaning method at its disposal, and can deal with anything its customers choose to send it in the best possible manner.

Chemical cleaning is especially valuable to doctors and nurses, and all those coming in contact with infectious diseases, it having been proved that this process not only destroys germs in clothing, but also renders the garments treated particularly immune.

The phrase "dry cleaning," or as the French call it, *nettoyage à sec*, originated from the fact that no water is used in the process. However, in reality, the garments are immersed and washed in benzine, benzol, or some other solvent. Thus the term "dry cleaning" is a misnomer, and the real definition of dry or chemical cleaning is immersion in a liquid which dissolves fat. It may be objected that the soap and soda used in ordinary washing dissolve fats, but in this instance it is not a case of solution pure and simple. What is dissolved is soap formed by the chemical action of alkali upon the fat, and not the fat as such. Any fat that is not converted into soap is emulsified, and passes away undissolved into the rinsing water. The definition of dry or chemical cleaning thus includes two points: Firstly, total immersion in a liquid, and not local applications of a liquid with a sponge, etc., the latter being merely a

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stain-removing process, and secondly, that the action of the liquid must be purely solvent, and must neither emulsify the fat nor alter it chemically. The fat must be recoverable from the solvent by simple distillation.

Although benzine and benzol are generally used as solvents, they are not the only liquids available. Ether, chloroform, acetic ether, carbon tetrachloride, alcohol, could all be used for chemical cleaning, although price and other considerations forbid their employment, or restrict it within narrow limits. Some of them, especially carbon tetrachloride, will no doubt be much more largely used in the future than they are now. Briefly stated, dry cleaning is based upon the solvent power for grease of benzine, benzol, and other solvents.

There are two common mistakes with regard to the dry-cleaning business. One is that anybody can clean with benzine, no matter what goods, and that no experience is necessary so long as the plant, *i. e.*, the washing machines and the stills for regenerating the benzine, are procured from a reliable firm. The other mistake is that a complicated and expensive plant is indispensable. Both of these ideas are erroneous. A dry-cleaning expert must have a knowledge of fabrics, and of the dyes they may contain, and the man who wishes to succeed must keep pace with the times. Many, probably most, of the cheap novelties seen in the shop windows are as awkward for the dry cleaner as they can well be. For instance, some silk shawls are dyed by sprinkling. The silk is always

loaded and gets stiff after spotting with water, the only possible spotting agent with these cheap and loosely dyed goods. The dyes commonly used are barely fast to cold water, and their appearance is spoiled by benzine, even if they are not stripped. The idea that the heavy dressing always given to such goods fixes the stenciled dye in any way is quite mistaken.

As regards the plant, the sole object of expensive installation is to economize in working on a large scale.

Most stains in garments consist of dirt held by grease of various kinds collected during the wearing of the clothes. By removing the grease—the dirt-carrying vehicle—the dirt is released and the stain disappears. As compared with the older method of cleaning, this process possesses great advantages, the possibility of shrinking and felting of woolen stuffs, almost unavoidable in the treatment with water, being entirely excluded. Furthermore, the most delicate colors are not affected or in the least injured, and richly-trimmed ladies' gowns can be cleansed without the necessity of ripping off any portion or removing the trimmings. The padding of men's coats is not shifted, and many household articles which would be rendered useless by the ordinary method of cleaning, may by this process be restored to the original cleanliness, and besides the expense of ripping apart and re-sewing is avoided.

As previously mentioned, the fluids chiefly used for this cleaning process are as follows: *Benzine, gasoline*

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and *naphtha*, *benzol*, *turpentine*, and, in more modern times, *carbon tetrachloride* or *tetrachloro-methane*.

There has always been more or less confusion over the correct nomenclature of the various fluids used for dry-cleaning purposes. A petroleum product for this purpose should have a boiling point low enough so that it readily can be driven from the goods being cleaned at ordinary dry-room temperatures, but it should not be so low that there is undue waste through evaporation, in which case the fire and explosion hazard is increased. The different grades of petroleum products are as follows:

*Petroleum Ether*.—Boils at from 40 to 70 degrees C. It is extremely wasteful to use as well as dangerous, as it evaporates rapidly at ordinary work-room temperatures.

*Gasoline*.—Boiling point 70 to 80 degrees C. Also wasteful and dangerous to use. This petroleum product is used chiefly for power purposes in internal combustion engines.

*Petroleum Naphtha*.—Boils at from 80 to 100 degrees C. Safer and less expensive to use than the products enumerated above.

*Grade B Petroleum Naphtha*.—Boils at from 100 to 110 degrees C.

*Benzine*.—Boils at from 120 to 150 degrees C. This product is sometimes known as "cleaning oil." This is the highest product obtained from petroleum and is the safest and the cheapest one to use. Its boiling point is such that it may readily be driven from the garments at ordinary dry-room temperatures and is

high enough to cause but a minimum waste by evaporation.

Benzine is a water-white, limpid liquid, with the peculiar and characteristic odor of petroleum. It is highly inflammable and requires handling with great care. It has a specific gravity of 0.730 to 0.760. A product having almost identical properties with benzine is *shale naphtha*, obtained by distilling Scotch shale. It has generally a slightly higher specific gravity, higher boiling point, and is not so volatile as the petroleum product.

As a solvent for oils and greases, benzine is not excelled, but no matter whence it may be derived, for the purpose of the garment cleaner, a product having a specific gravity of between 0.728 to 0.735 is the best, so that it can be readily expelled from the garments at the normal heat of a dry-room. A product of less specific gravity is not required, and makes the process more expensive by reason of the greater loss due to evaporation during washing.

Cleaning oils vary considerably in their characteristics, depending principally upon the crude oils from which they were derived. For this reason it is well to test the different grades being offered by the oil companies to determine the one best suited to the purpose. In the past it has been the custom of cleaners to buy their cleaning fluid on the basis of specific gravity, but this practice is now considered unreliable, as it is well known that specific gravity may be doctored to show any results desired by the distillers.

An oil for dry-cleaning purposes should preferably

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show the following characteristics: It should contain no oily deposit or foreign matter, nor should it contain substances that will leave an odor after the goods have been subjected to the heat of a dry-room. It should evaporate readily from the goods at ordinary dry-room temperatures and should have a boiling-point high enough so that there will not be an excessive waste through evaporation during the cleaning process. To test different oils proceed as follows: Place two or three ounces of each grade to be tested in a clean white porcelain dish, and note the order in which they evaporate. Should one or more dishes contain an oily deposit after evaporation eliminate the particular grade or grades from your consideration. The same test should also be performed in a dry-room to determine the action of the oils under the influence of heat. It sometimes will be found that an oil that evaporates but slowly in the air acts in an entirely different manner when subjected to heat. Such oil is generally difficult to reclaim by distillation.

The tests should be continued further by dipping pieces of cloth in the different cleaning fluids and watching the results when the evaporation takes place in the air and in a dry-room, and the odors, if any, remaining after the samples are free from the cleaning fluid. If a tumbler is used for drying purposes the samples should again be immersed in the fluids and dried in it and the effects noted. In all cases careful notes should be kept and the results compared. The tests may be modified to meet the conditions existing in any plant.

Benzine (gasoline), is not a definite chemical combination, but a mixture of hydrocarbons, a product obtained from crude petroleum. Benzol or benzene ( $C_6H_6$ ) is a definite chemical compound, a product obtained from coal tar. Benzol excels gasoline, in some respects, as a dry cleaning agent, but both are excellent solvents for oils and grease and serve to remove all ordinary dirt and grime from garments in the cleaning process. Dry cleaning soap added to the cleaning bath increases its detergent properties.

*Benzine soap.* When rubbed between the hands benzine causes a sensation of hardness which is due to the withdrawal of fatty substances from the skin. It has long been recognized that if an alkali, chiefly in the form of soap, or another chemical compound in a dissolved state, could be added to benzine, the cleaning power of the latter would be considerably increased, and its use could be extended to very dirty articles upon which, by itself, it exerts but little influence. For about twenty-five years endeavors have been made to add soaps to benzine by attempting to dissolve thoroughly dried soaps in benzol, alcohol, turpentine, etc., and adding the resulting product to benzine. Under the name of benzine soaps various products are now found in the market, and are much used, forming in fact an important item of the dry-cleaner's outfit. In 1893 Dr. M. Richter discovered that sharply-dried soaps of the alkaline earths, for instance, neutral magnesia soap, dissolve in benzine and possess the power of preventing electric excitation of the benzine and the



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consequent spontaneous firing caused thereby. The term *antibenzinpyrin* has been applied by the inventor to such soaps.

According to Dr. Richter, the oleates soluble in benzine may be classified as follows:

1. Hydrated acid oleate of the alkaline salts, called benzine soaps.

2. Anhydrous normal oleates of the salts of the alkaline earths, called *antibenzinpyrin*.

A very interesting fact is the power of the acid oleates to absorb water. This may be readily observed by adding, drop by drop, water to a ten-percent. solution of benzine soap. On shaking, the water yields a clear solution with the benzine soap. Attention may here be drawn to the fact that the goods to be cleaned always contain moisture, and as benzine does not mix with water, satisfactory results, without the use of benzine soap, can only be obtained by previously drying the goods as much as possible. With the use of benzine soap such drying is, however, superfluous. On coming in contact with the goods, the benzine soap absorbs the particles of water contained in a finely divided state in the goods, lays bare the fiber, and thus allows the benzine to exert its grease-dissolving power. Of course there is a limit to the water-absorbing power of benzine soap.

The solubility of benzine soap is, however, only conditional. From solutions<sup>4</sup> of less than 0.2 per cent. the soap is in a short time precipitated in the form of slime. Generally speaking, it may be laid down as a rule that the lower the temperature and

the more water the benzine soap has absorbed, the more readily precipitation will take place.

In addition it may be mentioned that the extremely disagreeable property of benzine soaps of being readily decomposed by weak acids is solely due to the content of water.

The well-known fact that in wet washing of, for instance, carpets and curtains from smoking-rooms, the soap frequently is suddenly broken, applies also to chemical washing, there being no doubt of its being caused by substances of an acid character. This difficulty, which cannot be foreseen, is extremely annoying and, as it frequently occurs, may even be called a calamity, because by reason of the decomposition of the benzine soap, protection from electric ignition becomes illusive. The fact is that hydrated benzine soaps are only anti-electric so long as they remain in solution and contain no more free oleic acid than the acid salt requires.

*Preparation of antibenzinpyrin.*—Dissolve 22 lbs. best quality white-grain soap (75 per cent. fat) in water, and, at about 203° F., add magnesium chloride or magnesium sulphate (Epsom salts) so long as separation takes place. The semi-liquid magnesium oleate floating on the surface is then removed and remelted with fresh boiling water. The product thus purified is wrapped in a linen cloth and freed from adhering water in an extractor. The product, which still contains water, is then slowly heated in a copper boiler to 266° F. by means of indirect steam. When the mass flows quietly, the steam is shut off,

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and 15 lbs. of odorless petroleum are stirred in. This anhydrous magnesium oleate is, while still in a liquid state, dissolved in 20 gallons of benzine. With the exception of a very slight sediment, the product should dissolve clear, and remain so; a slimy, white precipitate indicates that the magnesium oleate used still contained water, and consequently had not been long enough heated. Of this benzine solution one quart is to be used as an addition to every 25 gallons of benzine. Dilution may also be reduced to one-half, hence to about 10 to 11 gallons. In this case one pint suffices for 25 gallons of benzine.

A benzine soap, known as *saponine*, is manufactured by Gronewald & Stommel, Eberfeld, Germany. It forms a solid mass, somewhat softer than wax, and has a nearly white to yellowish-white color. It is an acid salt (alkaline oleate), which, in addition, contains a small quantity of water as hydrate chemically fixed. Its reaction is slightly alkaline. It does not dissolve in distilled water.

In water saponine can only be partly distributed, a milky fluid being formed which lathers strongly when shaken. On the other hand, it is soluble in 98 per cent. alcohol, in amyl alcohol, ether, benzine, chloroform, acetic ether and carbon tetrachloride. By an addition of saponine the power of benzine as a solvent is greatly increased, and by the content of soap it also acquires the capacity of absorbing more water than otherwise is the case without losing thereby its power of extracting fat and fatty substances.

According to the English patent specification

saponine is made by melting together equal or nearly equal parts of oleic acid and soap, the heating being continued until a clear liquid is obtained; it is then allowed to cool.

*Universal benzine soap* is manufactured and brought into commerce by J. Simon & Dürkheim, Offenbach, Germany. It is a liquid, neutral soap, the fatty matters contained in it being completely saponified. In addition to soap it contains ingredients which by reason of their composition exert a powerful dissolving effect, and serve for the removal of stains of resins, asphalt, tar, oil-paint, axle-grease, street dirt, etc.

*Weralin* is manufactured by Oscar Gans, Halle, Germany. It is a liquid of a yellow color and has a not disagreeable odor reminding one of mirbane oil. The fluid, when poured in a porcelain dish, evaporates in a short time, a yellowish soft soap-mass remaining behind.

*Liquid benzine soap* is brought into commerce by Egmont Koehler, Altenburg, Germany. It serves for washing colored and white glace gloves. Benzine compounded with this soap readily removes by one application by means of a piece of felt all the dirt, even the hardest perspiration stains becoming soft thereby.

Very satisfactory soaps freely soluble in benzine to a clear solution can, according to Frank J. Farrell, be made by dissolving caustic soda or caustic potash in the smallest quantity of methylated spirit, and stirring it into the required quantity of oleic acid or melted stearic acid, and heating the mixture on a

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water bath. In place of soda or potash, ammonia (0.880 specific gravity) may be employed, with or without the addition of methylated spirit. The following quantities give satisfactory results: Oleic acid 5 parts by weight, caustic potash 1 part by weight dissolved in methylated spirits 4 parts by weight.

The quantities are arranged to produce a slightly superfatted soap, freely soluble in benzine. By increasing the quantity of oleic acid, the solubility of the soap in benzine is increased.

Ernest Regnal has patented in Germany a benzine-soluble soap solution of fatty acids, of animal as well as of vegetable origin, alcohol, ammonia and water, which contains about 38 per cent. of water. For five to six garments about  $\frac{1}{2}$  to 1 lb. of this solution is to be added to the benzine to be used for washing, and about 2 lbs. for five suits, or 6 to 12 square yards of carpets.

The fabrics to be cleaned are for a certain time subjected in the washing machine to the action of the benzine and the added soap solution, garments for 20 to 25 minutes, suits and carpets for 35 to 45 minutes.

After this treatment the articles are for a corresponding time washed in the machine with pure benzine, then extracted, and dried at a good heat in the usual manner. By the use of the above-mentioned soap solution, it is claimed, stains of all kinds, such as of beer, gravy, blood, or street-dirt are completely dissolved by reason of the presence of ammonia and the large content of water.

A soap solution especially suitable for the process is obtained by heating 21 parts by weight of 25 per cent. ammonia, 9 parts by weight of alcohol and 23 parts by weight of water, then adding about 47 parts by weight of a fatty acid, for instance, oleic acid, and allowing the whole to boil. In this manner a soap is obtained with about 5.3 per cent. of anhydrous ammonia, 9 per cent. of alcohol, 38 per cent. of water and 27 per cent. of fatty acid. This soap may also be prepared in such a way that, while the content of alcohol and fatty acid remains the same, that of anhydrous ammonia rises from  $2\frac{1}{2}$  per cent. upwards and that of water from 21 per cent. upwards.

Below a few formulas for the preparation of benzine soaps are given:

1. *By means of ammonia.* Melt 100 lbs. crude tallow fatty acid at from  $87^{\circ}$  to  $122^{\circ}$  F., bring into the liquid mass 40 lbs. caustic lye (15.6 per cent. caustic potash) of  $17^{\circ}$  B., stir thoroughly and add to the semi-solid mass, at an always constant temperature, 8 to 10 lbs. of ammonia of 0.910 specific gravity, and 40 lbs. more of melted tallow fatty acid.

The soap thus prepared can then be mixed in suitable proportion with benzine to form a paste.

2. *Liquid benzine soaps.* a. Add 50 lbs. ethyl acetate or acetic ether to 3 lbs. best quality of soap which should be free from such additions as dextrin, potato flour or mineral substances. When solution, which is effected in the cold way, is complete, the soap is finished. It is then mixed with the suitable quantity of benzine and filled into bottles.

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b. Add to 15 lbs. of 90 per cent. alcohol 5 lbs. best quality pure white Marseilles soap and effect solution on a water bath. To the resulting solution add, without the assistance of heat, 50 lbs. of benzine, 10 lbs. of crude benzol and 5 lbs. white olein. Allow the mixture to settle and then siphon it off into tin bottles.

*Solid benzine soap.* Olein 56.6 lbs., ammonia of 0.91 specific gravity 6.8 lbs. Bring the olein into an enameled kettle provided with a stirrer and, whilst constantly stirring, run in the ammonia in a thin stream. By reason of the chemical reaction which takes place, the mass becomes at first heated and more liquefied. Keep the stirrer in motion for about  $\frac{3}{4}$  hour till the mass becomes hard; when cold it is almost white. For the preparation of a soap of prime quality, the use of almost white olein and 25 per cent. ammonia is indispensable. The mass must not be heated during or after the operation, as otherwise the ammonium oleate is again decomposed, and it must dissolve clear in benzine. If, however, a clear solution should not result, add gradually water in a thin jet until a sample dissolves clear in the solvent. Too much water, of course, renders the benzine turbid, and great care has to be observed during the entire operation. Chief conditions are: Unexceptional products as initial materials and constant vigorous stirring at as quick a pace as possible.

Anhydrous acid extract of alkali dissolves in boiling benzine, but on cooling congeals to a jelly. However, by adding water very gradually, whilst constantly

stirring, a point is reached when everything is, and remains, dissolved. If more water then be added, it is no longer absorbed by the benzine. For the technical preparation of such acid oleates, which after hydrating are called saponoleines and are used for benzine washing, three methods may be used.

1. Melting together molecular quantities of neutral alkaline soaps with olein.
2. Half saturation of oleic acid with caustic alkali or alkaline carbonate.
3. Half saturation of the neutral oil soaps with stronger acids.

Should the cleaner desire to purchase his benzine soap he will find a number of good ones made in this country on the market, all of which will give the desired results if used according to directions. A good soap should contain no water or filler, should dissolve readily in cold gasoline and should leave no residue. Unless the soap dissolves in cold gasoline it will not be completely rinsed from the goods. As a general rule, from one to two pounds of soap should be added to each forty gallons of gasoline in the washer.

1. *Benzol (benzene)*. This liquid is obtained from the portion of coal tar boiling at  $212^{\circ}$  F. It is a water-white, limpid liquid, is strongly refractive, and has a peculiar aromatic odor and taste. It boils at from  $176^{\circ}$  to  $212^{\circ}$  F. Its specific gravity is 0.85 to 0.88. It is easily inflammable, burning with a luminous, smoky flame. It is very volatile and when exposed to the atmosphere vaporizes without leaving behind any residue. It is a powerful solvent for all oils and fats, and yields excellent results in dry cleaning,



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but, though somewhat cheaper now, is still too expensive for the purpose.

Benzine can be distinguished from benzol in the following manner: Benzine is colored violet by a crystal of potassium iodide, while benzol is colored carmine. If two cubic centimeters of benzine, three or four drops of a clear ether solution of sandarac (1 to 10) are added a persistent cloudiness is produced in the benzine, while with benzol heated in the same manner the cloudiness will soon pass away. Finally, if the benzol is shaken with a drop of alcohol, it will become clouded, while the benzine will remain clear.

Benzol has not the slightest action on the most delicate tints and colors, and new stuffs frequently acquire a much finer appearance when washed with it previously to being sold.

2. *Turpentine*. This product was formerly known as oil or spirit of turpentine, but these terms have in the course of time fallen into disuse, and the name of turpentine, originally applied to the resinous material itself, is now generally given to the volatile liquid used by painters for cleaning purposes, etc.

Turpentine is obtained by distilling the oleoresinous exudations of various species of *Pinus*. The crude turpentine is put into a large still, heat is applied, and a little water from time to time added to the contents of the still. Distillation is continued so long as turpentine passes over, when the resinous residue is run off through a stop-cock at the bottom of the still, is passed through several strainers, and then constitutes *rosin*. On condensing the distillate, the

turpentine separates from the water and is dipped into barrels, in which it enters commerce.

Turpentine is a water-white, clear liquid of a peculiar and very characteristic odor. It is lighter than water, its specific gravity varying between 0.85 and 0.87. It is insoluble in water, although it imparts its odor to it. It boils at about 302° F., and is completely distilled at a temperature of 338° F.; old samples may, however, leave a very small residue behind them.

Turpentine is readily combustible; it flashes at 97° to 100° F., and at a slightly higher temperature burns with a luminous flame accompanied with the emission of much smoke.

Of the different varieties of turpentine the French product is the best. It is, however, almost exclusively consumed in France itself, very little, if any, being exported. American and Russian turpentines are the next best varieties for the purpose of dry cleaning. They have very similar properties, Russian turpentine having rather more odor than the American product. Austrian turpentine cannot be recommended, it always showing a slightly yellowish color even when thoroughly rectified.

German turpentine, obtained by destructive distillation of various species of *Pinus*, should not be used, as it possesses a peculiar odor which cannot be removed from garments treated with it. Besides, it rapidly turns yellow on exposure to air, and resinifies.

Although turpentine is an excellent solvent for grease, oils, etc., it is not a good material to use with the dry process, it being apt to leave behind a some-

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what unpleasant odor. This is more likely to be the case with Russian than with American turpentine, and when the garments are dried slowly. For this reason it is but seldom used, although frequently recommended for removing oil and paint stains from garments.

There is no good reason for the generally prevailing idea that turpentine, when used for cleaning silk stuffs, imparts to them a soft feel and greater luster and softness.

*Carbon tetrachloride or tetrachloro-methane*,  $\text{CCl}_4$ , is a colorless, mobile, volatile fluid, of a peculiar chloroform-like odor. It is heavier than water, having a specific gravity of 1.629; boiling-point  $170.6^\circ \text{F}$ . It is now prepared on a large scale by the reaction of carbon bisulphide with chloride of sulphur, which are both bodies readily and cheaply prepared by the direct union of their elements. Besides, the by-product of the reaction is free sulphur, which can be reconverted into carbide and chloride, for use again, as the whole of the sulphur is recovered.

Carbon tetrachloride is coming more and more into use for dry cleaning, and in other ways as a solvent for fats and greases on account of its non-inflammability, which gives it an enormous advantage over benzine. Although still more expensive than benzine, it is cheaper than it used to be, and thanks to improved methods of manufacture, there seems to be a good chance that in the near future it will not greatly differ in price from benzine, which in time will probably become more expensive. There is no limit to the

artificial production of tetrachloride, but benzine cannot as yet be obtained except from petroleum, and it is impossible that this natural product will be obtained on the present enormous scale for a much longer time. It must not be forgotten, moreover, that the user of carbon tetrachloride has a great advantage over the user of benzine in respect to fire insurance. Carbon tetrachloride is neither combustible nor explosive, and poured upon a fire puts it out exactly as so much water would do. It is slightly poisonous, but its fumes are no more deleterious than those of benzine.

Even the best samples of benzine are apt to leave some smell behind them in goods which have left the cleaner. Whatever may be thought of the smell of carbon tetrachloride during use it is only in the rarest cases, when it has been used on heavy woollens for the most part, that it leaves any trace of odor perceptible to the dry-cleaner's customers. Moreover, the effect upon dyes has to be considered. Dry cleaning with benzine is less likely to affect sensitive dyes, especially in light shades, than wet washing. It is, however, true that carbon tetrachloride affects such dyes as a class less than any kind of benzine, and is therefore especially adapted for cleaning garments dyed in delicate tints, and particularly when the fabric is an expensive one, such as silk. These are evidently cases when the excess of cost to the cleaner involved in the use of carbon tetrachloride is of comparatively small importance.

Another advantage of carbon tetrachloride is that

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it can be used in combination with the cheaper benzine. The cleansing power of the mixture is at least equal to that of pure benzine, and the addition of the carbon tetrachloride checks to some extent any tendency to firing of the benzine by electricity or otherwise.

In stain-removing, carbon tetrachloride is quite as effectual as benzine, and has much less tendency to spread out and make perceptible outlines at the place where it is applied. For this purpose it can also be mixed with benzine. In glove-cleaning carbon tetrachloride leaves the leather softer and less liable to crack on stretching than is the case when benzine is used.

One other important point still remains to be mentioned. There is much loss by evaporation when benzine is employed, both during the use and during the storage of the liquid. In use this loss is largely unavoidable, but is less in the case of carbon tetrachloride than with benzine, as the former has a higher boiling-point than the latter. In storage the loss which is so difficult to prevent in the case of benzine, especially when the stock is frequently drawn upon, can be completely avoided in the case of the tetrachloride by covering it with a deep layer of water. Carbon tetrachloride is more than half as heavy again as water and will not mix with it. Hence the water swims on the top and effectually prevents all evaporation of the carbon compound, which can be drawn off at will from under the water. It is well known that benzine is to some extent mixable with water, and also that wet benzine is quite useless for dry-cleaning

purposes. The water over the carbon tetrachloride should be kept at a good depth, say three or four inches, so that there may be not only an effectual barrier to the escape of carbon tetrachloride vapor, which has a very perceptible tension in hot weather, but a superincumbent weight will accelerate the flow of the carbon compound from the reservoir. Carbon tetrachloride exerts an injurious action on copper, and, therefore, it cannot be used in containers and equipment where it will come in contact with this metal or brass.

#### PRECAUTIONS IN DRY-CLEANING ESTABLISHMENTS.

It is scarcely necessary to say that in working with benzine or benzol, and even with oil of turpentine, the greatest care has to be observed. Naked lights or a stove should not be allowed in the work-room. Where incandescent electric light is available, the burner should be in a double air-tight glass cover. Failing electric light, the room should be lit from outside through an air-tight window.

Benzine and benzol are not only highly inflammable in a liquid state, but have such low boiling-points that they give off large volumes of vapor at ordinary temperatures. This vapor is of course combustible like the liquids, but unlike the latter, it can, by mixing with air, form a dangerous and powerful explosive. Two conditions must exist before combustion or explosion can take place. One is that the liquid or the vapor must be in contact with oxygen,

*i. e.*, in practice with the air, and the other is that there must be a sufficiently high temperature where the two meet to cause chemical action between them. If either of these conditions is absent there is no possibility of ignition or explosion. Now experience has shown that the temperature which meets the second of the two essential conditions may be comparatively low, and may be reached in various ways with the intervention of a flame or an electric spark.

In an ordinary dwelling-house the use of benzine or gasoline is fraught with great danger. Both vaporize at ordinary temperatures, and the vapor is not absorbed in the atmosphere, but falls to the floor level where it flows in a stream in the direction of any air current by which it may be affected. If this stream should happen to come in contact with a flame in another room, it would carry the fire back to the bulk of the benzine or gasoline and cause an explosion.

Benzine-cleaning establishments should be designed and constructed with great care, so that there is no possible chance for vapors to collect and ignite from stray sparks, that there is no leakage, and finally that the room where the work is done on the material to be cleaned is so completely ventilated that the workmen can be present at all times without any danger to themselves.

In the larger cities there are stringent laws governing the design and construction of buildings that are to be used in which to do dry cleaning, and the cleaner is not allowed a great deal of latitude insofar as the type of construction of his plant is concerned. He

must follow certain plans and specifications looking to the safety of his plant and the property of his neighbors. Therefore, as the first step, the man who is contemplating the erection of a building in which to do dry cleaning should carefully look up the laws of his city and state governing the subject.

In most instances only a one-story, fireproof building is allowed. The floor and roof should be of concrete, and the windows glazed with wire glass set in metal sashes. The size of the building should be governed by the particular requirements existing in any instance, but in any event the room should not be larger than necessary, for the larger it is the more difficult it will be to keep it well ventilated and to change the air at frequent intervals. The side walls and the roof should be of heavy construction so that they will not collapse in the event of an explosion.

The building in which the cleaning work is to be done should be separated from the other buildings of the plant by at least six feet—farther if ground space permits. No basement should be allowed under the building. Gasoline is heavier than air and tends to collect in low spots where it may remain for some time and eventually cause an explosion. Windows and doors should be provided with some arrangement that will close them automatically in the event of an explosion. Steel shutters that may be operated from the outside are an additional protection in the event of fire.

The artificial lighting should be by incandescent, vapor-proof lamps, in keyless sockets suspended high



enough above the floor to eliminate danger of breakage through accident. All electric wiring should be installed in metal conduit, and all switches placed outside of the room in metal switch-boxes. If a motor is used for power it must also be placed outside of the room and connected to the power shaft by extending the latter through the wall.

The subject of ventilation is of the utmost importance. Unless the cleaning-room can be kept free of gasoline vapor at all times a serious explosion is very sure to occur at one time or another. When possible all doors and windows should be kept open, and an exhaust fan with a capacity sufficient to change the air in the room every four or five minutes should be installed at some point in the room near the floor line.

Next to proper ventilation, the most important feature of a cleaning-room is the fire extinguishing system. In all of the modern plants steam is used for this purpose. A steam-pipe of sufficient size to flood the room with live steam in a short interval of time should be run into the cleaning department. This pipe should be divided into several branches, with outlets opening toward the ceiling, so that the steam blanket will be evenly distributed. The combined cross-sectional area of the branches should not be greater than the cross-sectional area of the main pipe. The steam should be controlled by a quick-opening valve placed outside of the building. In the event of a fire the door and windows are closed and the steam turned on. The oxygen is thus exhausted

and the fire extinguished. A boiler of sufficient capacity to take care of the ordinary needs of the establishment and such an overload as would be necessary in the event of a fire should be installed. A steam pressure of at least eighty pounds should be maintained during those times the dry-cleaning department is operating.

The gasoline should be stored in underground tanks which are connected through a pump and a system of piping to the various machines. A series of valves permit the gasoline from any tank to be pumped to any machine or from any machine to any tank. Such a storage system soon pays for itself in the gasoline saved. In addition it provides an absolutely safe method of storage and distribution of the cleaning fluid. Such a system is shown in the accompanying illustration. A storage system such as this may be had from one of several manufacturers who specialize in the manufacture of gasoline storage and handling systems. Litharge, or litharge and glycerine, should be used for making up all joints in the gasoline piping system. If gaskets are necessary paper and not rubber should be used.

All machinery, shafting and hangers should be grounded to carry off any static electricity that may be generated. The usual method of grounding machinery consists in attaching one end of a wire to the machine to be grounded and the other end to a ground, such as a water-pipe or the piping of the underground gasoline storage system.

What has been said regarding the construction and

arrangement of the dry cleaning room applies with equal force to the dry room. When possible, this room should be separated from the remainder of the plant, and it should be of fireproof construction throughout. The heating should be done by steam from pipes ar-

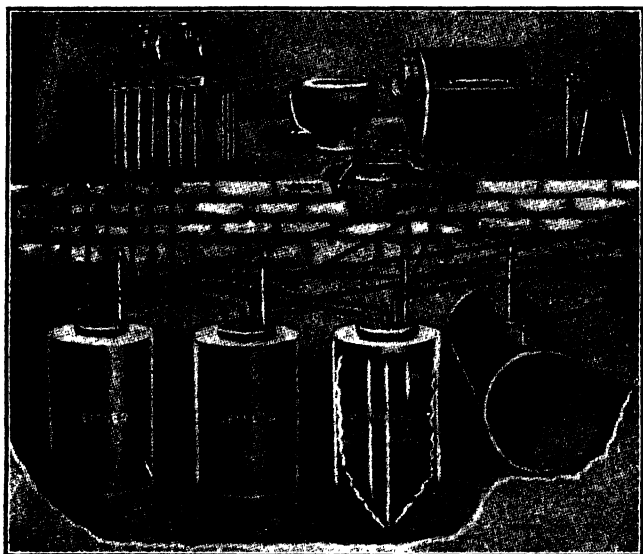


Fig. 1.—An Underground Gasoline Storage System

ranged at or near the ceiling. Adequate provisions should be made for carrying away the gasoline fumes as fast as they are liberated from the garments being dried. Artificial lighting should be by incandescent electric globes of the same type and installed in the same manner as described above. A steam

line to extinguish any fire that may start is a necessity.

All vessels (extractors, washing and rinsing machines, etc.) containing inflammable liquids should have adequate covers, and should as far as practicable be kept closed during use. The covers, moreover, should be balanced, so that if forced open by explosion they will fall back by their own weight and cut off the air supply from the burning liquid; or in case of rinsing vessels which cannot be kept closed during use, an iron cover should be suspended from above by a chain passing to a catch at some distance from the vessel, when in emergency it can be immediately set free, so that the cover will fall. In most large establishments the use of rinsing vessels has been entirely abandoned, and rinsing is effected in closed washing machines with clean benzine. A loud crackling noise heard while rinsing in benzine may be considered as a forerunner of static ignition. In this case allow the goods to rest quietly for some time in the vessel, and, if possible, introduce moist air into the room. Such spontaneous ignition occurs more frequently with white, than with dark colored, goods. Attention is also directed to special safety appliances which are now available for the storage of inflammable liquids.

By the means above described the risk of fire and explosion can be greatly lessened, but it is still necessary to make provision for minimizing these effects. There should be an ample water supply, with hydrants and hose, in order to prevent the extension of

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flames, but water should not be used in attempts to extinguish burning benzine. For the latter purpose blankets and a supply of sand should be kept in readiness. Steam jets, as explained above, are a necessity in the event of fire, as well as for the purposes of humidification when the air is dry.

Ammonia is also an excellent fire-extinguishing agent. When thrown in a hearth it acts immediately; instead of flames, volumes of black smoke rise up, and every trace of fire disappears. As a fire may cut off the ordinary exit, more than one opening to the outside should be provided. All persons employed should have clear instructions what to do in case of fire, and wear woolen or other non-inflammable outer garments.

Ignition by static electric sparks, which is now recognized as the cause of most instances of so-called spontaneous firing of benzine, is due to the fact that textile fabrics—especially undyed wool and silk—and many other materials become electrified when rubbed or moved quickly in benzine, and sparks may result, causing explosion.

Dr. W. Richter attributes spontaneous firing to the formation of sparks by the alteration of the positive electricity of the wool with the negative electricity of the benzine. Whether the formation of sparks is promoted by metals has not yet been determined. Spontaneous firing may also depend on a mixture of benzine and air in certain proportions. Experiments have shown that the risk of sparking is greatly increased in frosty weather and when the air is especially dry.

In Paris no dry-cleaning establishments are allowed within the city limits. This, of course, is a protection from fire as far as houses in the city are concerned, but not the establishment itself. To decrease danger from fire, F. Fischer has recommended to artificially increase the content of moisture in the air by steaming or otherwise. This can be readily done if steam jets are available. While Dr. Richter considers this an excellent plan, it is unfortunately not very suitable for dry-cleaning establishments, as the moisture might impair the effect of chemical cleaning. It has also been recommended to increase the viscosity of benzine by the addition of fat, to diminish friction. But neither this nor the addition of alcohol, ether, or chloroform, has proved of any effectual use.

As a result of a series of tests on the well-known use of carbon-tetrachloride in diminishing the risk of fire in dry cleaning, Mr. G. A. Barrier, a member of the American Chemical Society, has come to the following conclusions:

1. A certain percentage of naphtha can be added to carbon tetrachloride and still leave the mixture free from fire and explosion hazard.
2. The percentage which can safely be added varies with the specific gravity of the naphtha.
3. A 55-degree naphtha at ordinary room temperatures is practically free from explosion hazards, but in order to be reasonably safe from fire hazard it should contain at least 30 per cent. of carbon tetrachloride.
4. A 63-degree naphtha at ordinary room tempera-

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tures has a slight explosion hazard, but in order to be reasonably safe from fire hazard it should contain at least 45 per cent. of carbon tetrachloride.

5. A 70-degree naphtha, in order to be safe from explosion hazard, should contain at least 50 per cent. of carbon tetrachloride, and to be reasonably safe from fire hazard should contain at least 60 per cent.

6. A 76-degree naphtha, to be safe from explosion hazard, should contain at least 60 per cent. of carbon tetrachloride, and to be reasonably safe from fire hazard should contain 70 per cent.

These statements apply only to naphthas which show approximately the same results on distillation—especially with respect to the lower boiling fractions—as those tested. The expression “reasonably safe from fire hazard” is used advisedly, since the above mixtures, while possessing little fire hazard in open containers, will burn if spread out over a considerable area on any really combustible material, such as cotton waste. The percentages of naphthas are minima, and good practice would require an additional 5 per cent. of carbon tetrachloride for safety.

As previously mentioned, benzine may be rendered less liable to ignition by electric sparks by the addition of soap. According to Dr. Gartenmeister, an addition of 0.01 per cent. of magnesia soap prevents electric excitation in the goods so long as the magnesia soap is not separated by water or decomposed by stronger acids.

An addition of 0.01 per cent. of benzine soap—hydrated acid alkali oleate—also prevents electric

excitation so long as the soap is not precipitated as anhydrous soap by the withdrawal of water, or decomposed by a stronger acid.

The employment of magnesia soap in addition to benzine soap is useless.

For the prevention of electric excitation the required small quantity—0.01 per cent. of benzine soap or magnesia soap—should be added to the pure benzine in which the washed goods are rinsed.

However, in most cases the necessary quantity of benzine soap remains in the tissue from washing.

In dry-cleaning establishments there is always some chance of the inhalation of benzine vapor which is a powerful nerve-poison. Even in minute doses it causes headache. The best method of prevention is thorough ventilation. A person suffering from the action of benzine vapor should be brought into the open air and cold water should be poured over his scalp. At the same time efforts should be made to induce vomiting.

At one time it was claimed that the vapors of carbon tetrachloride were poisonous, but many tests made upon animals and birds, besides the records of cases where human beings were overcome with the vapors, led to the belief that it has no greater injurious qualities than benzine.

*Treatment of burns.* In few difficulties is early attention more imperative than in burns, hence the importance of useful knowledge on this subject that something effective may be done while waiting for the physician.



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Large superficial burns are more dangerous than small deep ones unless the latter are over a vital organ. As a rule, the amount of skin destruction measures the danger. Promptness of treatment has much influence on the outcome. Burns upon the abdomen give the highest mortality.

The white of egg beaten up with sweet oil and bicarbonate of soda makes a very soothing application, protecting the surface from the air. If sweet oil is not at hand linseed oil or any other vegetable oil will do.

It is well to have ready for application to burns of not very large extent an ointment compound as follows: Ichthyol ointment, 1 oz.; carbolized petrolatum, 1 oz.; zinc ointment, 1 oz.; subnitrate of bismuth, 1 drachm; powdered opium, 1 drachm. This ointment may be applied freely and will be found to give almost immediate relief.

If a burned hand or foot is plunged at once into a basin of water into which a few spoonfuls of powdered saltpeter are placed, the pain often ceases at once. If it returns, adding fresh cold water and more saltpeter will again stop it. Follow this with one of the preparations mentioned, and you will do a great deal for the comfort of the patient.

If the patient is much shocked by the burn give a teaspoonful of aromatic spirits of ammonia in some cool water, or a tablespoonful or two of brandy, and apply, to points not burned, hot-water bags. Do this especially when there is chilliness, and send for a physician at once.

### THE CLEANING PROCESS.

The process of dry cleaning falls under two heads—washing proper and stain removing or “spotting.” In the washing the goods are sorted as regards degree of dirtiness, color and material. Delicate articles are treated apart. The stain removing follows the cleaning with benzine. It is by far the most difficult part of the whole treatment of the goods, because such stains as resist the benzine, as a rule, require water for their removal, so that all the dangers attend the use of water which dry cleaning is expressly designed to avoid. The only thing to be done is to use distilled water and to proceed with the utmost caution. Stains which resist both benzine and water must be treated individually. The subject of removing stains, or “spotting,” as it is called, will be referred to later on.

Dry cleaning is not adapted for every kind of tissue, and the first proceeding should be to sort the goods to be cleaned.

Suitable for the dry process are:

- a. White silk fabrics and ribbons, and such as contain other colors, but in which white is nevertheless the prevailing color.
- b. Woolen and half-woolen fabrics.
- c. Silk-velvet and other colored silk stuffs.
- d. Light-colored woolen and half-woolen fabrics.
- e. Dark-colored articles.

It is especially advisable to keep velvet, plush, and

other goods with a pile surface separate from other kinds of material.

*Less suitable* for dry cleaning are half-silk fabrics, as well as cotton and linen stuffs.

*Not suitable* for dry cleaning are especially white linen and cotton pantaloons, vests, sun and rain umbrellas, satin shoes, etc. These articles, which, for reasons readily understood, cannot be brought into the wash machine, require cleaning by hand with the tampion and brush.

Colored articles which bleed when treated with the tampion must, of course, be separated to prevent other stuffs, especially white or those with a white ground, from becoming smeared. This generally happens with stuffs dyed with tar colors, which have not been sufficiently steamed.

There are a number of methods and several kinds of apparatus for carrying out the actual process of dry cleaning according to whether the work is to be done on a large or small scale; the principle of cleaning being, however, the same in every case.

It is a great advantage and saving of time and benzine to get as much dust as possible beaten or shaken out of the garments. This may be done with whips on a mattress if a dust wheel is not available. If sticks are used buttons get broken and other damage ensues. A slowly revolving dust wheel similar to, but smaller than, the type used for carpet dusting, is a very good machine for the purpose. It may be either cylindrical or star-shaped. It is essentially a revolving cage, varying in diameter from 5 feet to 14 feet, being

constructed of wooden bars set slightly apart so that the dust, etc., loosened by the articles rubbing against each other in the slow process of revolution, may fall between them. This wheel should be installed in a closed compartment, otherwise the dust will find its way through the plant and cause no end of trouble. A fan should be installed in a wall of the compartment to carry the dust outside of the building as fast as it is liberated from the garments. Hooks should also be closed with pliers to prevent them catching and tearing anything. After dusting, the garments should be thoroughly brushed, especially the pockets, with a medium stiff brush. Too hard a brush is apt to tear the wool from men's garments which may cause shiny spots. For garments of soft or fine texture a soft woolen rag made into a ball may be used in place of a brush. This woolen rag should be as near as possible of the same color as the article to be cleaned, *i. e.*, a light colored rag should be used for light stuffs and one of a dark or black color for dark stuffs. A chief requirement is that the brushes, rags, etc., used are themselves clean; further, that they are perfectly dry, *i. e.*, free from moisture.

Finally, if the weather is wet or the garments damp, they should be dried to remove any moisture they contain, as the presence of water prevents the benzine from acting. If there is water in the benzine or in the goods, damp places will be formed in the latter. These places retain their own dirt and absorb dirt from their immediate neighborhood, and the dirt in them is effectually protected from the detergent action

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of the benzine. The result is that the goods leave the washing machine covered irregularly with dark stains. If treated at once these stains can generally be removed quite readily by means of a good rubbing and brushing with benzine soap. If, however, the goods have been dried they often resist this treatment successfully, and nothing remains to be done but to wash them all over again, taking care, of course, to use perfectly dry benzine. White woolen goods often show up dingy and gray after being dry cleaned. The cause lies in water in the gasoline or dampness in the goods themselves. Correction may be made by recleaning in dry benzine. It is obvious, however, that, on the ground of economy, both of benzine and of time and labor, prevention is better than cure, and the following simple method is invariably successful. Should the benzine be wet, a few yards of white and perfectly dry cotton cloth should be run in the machine with the benzine for a few minutes. The cotton will absorb the whole of the moisture, and after its removal the ordinary washing can be safely placed in the machine. After the cotton has been used a few times for drying the benzine, it cannot be trusted to take up the water efficiently. It is, therefore, extracted, dried, wet-washed, and again made absolutely dry. It can then be used again for the same purpose. If this procedure is followed, the same piece of cotton can be almost indefinitely used.

In establishments containing no hand or power operated machinery the actual process of dry cleaning may be carried on as follows:

Five ordinary galvanized iron wash-tubs are necessary. The tubs should be of large size to allow for the required handling of garments in the cleaning and rinsing operations without involving waste of gasoline from slopping over. Put from 5 to 10 gallons of gasoline, according to the amount of work to be done, in each of the tubs. In the first tub dissolve one ounce, or more, of any good dry cleaning soap to each gallon of gasoline used.

Sort the garments, in respect to color and condition, into several piles: 1. Pure white. 2. Light colors, such as gray, tan, buff, etc. 3. Darker colors, mixed suitings, etc. 4. Dark blue, dark brown, or black. 5. Dark colored garments that are badly soiled.

Proceed with the cleaning by taking the white garments first, then follow with the other piles in order. The garments are taken, one at a time, and dipped into the first tub (containing soap) and placed upon a table covered with sheet zinc (see Fig. 6), then brushed well by means of a stiff bristle brush, using freely of the soap-bath in the operation. Care must be taken to avoid damage to silk or other delicate fabrics in the process. After each garment is brushed it is handled again for a moment in the soap bath and passed in order through the rinses. As the cleaning proceeds and the rinses become unfit, they are replaced with fresh gasoline, those first employed being added to the brushing bath, without soap, for use in brushing the dark goods. It will be observed that what at first was the second rinse now becomes the first—and so on according to the amount of cleaning to be done.

The garments should be handled well in the rinses, and the gasoline squeezed out as much as possible before passing from the brushing bath to the first rinse and also between the following rinses, as this attention prevents the rinses from becoming unfit as soon as they would otherwise. When a hand-extractor is available, several pieces may be handled at a time in each rinse and then extracted before placing them in the next rinse. When this is done, the gasoline draining from the garments in the extractor should be returned to the tub from which it came.

When the cleaning and rinsing is completed the gasoline should be put away to settle in cans or small tanks in the same order in which it has been used; that is, the gasoline remaining from the brushing and also that which has finally become the first rinse together in one tank to be used for brushing purposes on starting the next lot of cleaning, and the rinses in separate vessels so they may be dipped out and used in the same order as before. It will be seen that by this method of taking care of the used gasoline the greatest benefit will be derived from it, as rinses, before it is finally used for cleaning purposes. The brushing gasoline will be amber colored after settling, but if it is free from dirt it will be suitable for preparing the cleaning bath by adding more soap and handling a yard or two of bleached cheese-cloth in the bath to absorb any moisture which may be present; this, however, will not be necessary for the rinses. White and also light colored garments should be dried well just previous to cleaning.

By this treatment the articles are thoroughly cleaned as far as can be done with benzine. It must, however, be mentioned that all stains produced by alkalies, acids, sugar, milk, etc., resist the action of benzine. The same is also the case with the so-called sweat-stains, which are caused by a change in the color. To remove such stains, the separate places must be subjected to a special treatment, as will be explained later on.

The method above described is very practical, but possesses the inconvenience of the operator being much exposed to the vapors of the benzine. This may, however, be avoided by carrying on the work under a well-drawing chimney. When working in this manner the utmost precaution must be observed to prevent accidents. The room should be kept well ventilated, and the vessels kept tightly covered when not in use. Also, care should be taken not to drip gasoline on the floor when transferring garments from one vessel to another.

For draining the articles, a tall cylindrical vessel of zinc or copper, provided with a perforated false bottom, is generally used. The adhering benzine drains off through the perforated bottom, and is from time to time drawn off through a cock near the true bottom of the vessel. The vessel may also be provided with a movable lid and screw, so that by applying pressure this portion of the operation is accelerated.

Silk articles are simply washed by hand in the above-described manner, as otherwise they would



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suffer too much. Besides, if only individual stains have to be removed, the articles, with the exception of the stained portion, remain intact, and the latter itself is only treated with the greatest care. The laws of a great many states and cities now prohibit doing cleaning work by hand in the manner above described. The man who is contemplating entering the business should thoroughly acquaint himself with the laws of his state and city on this subject.

For working on a larger scale, the arrangement above described is, however, unsuitable. The arrangement to be described here depends on using a heavy benzine of 0.74 to 0.85 specific gravity for washing and rinsing. After cleansing, the goods are dried in a closed chamber.

The use of heavy benzine has many advantages. Being less volatile than the lighter kinds it does not waste so much by evaporation, neither is it so liable to accidents by fire.

The plant necessarily consists of washing machines, machines for washing and rinsing, extractors, a still for reclaiming gasoline, a dry-room, an underground gasoline storage system, and cleaning-tables. If the volume of business is large enough, auxiliary machines consisting of a tumbler, a steam-board, a benzine clarifier, glove-cleaning machines, etc., will be needed. The size of each of these machines will depend, of course, on the particular conditions existing in any plant. In any event the equipment should have a capacity more than sufficient to take care of the present needs. The power-operated machines should

be placed along one side of the room to permit all of them being operated from one power shaft. The arrangement of the machinery should be such that a minimum amount of handling will be required to complete the day's work.

All machines and vessels used in a dry-cleaning establishment should have tight-fitting covers in order to prevent evaporation of the solvent employed.

All kinds of benzine washing machines, both for hand and power, are on the market, and there should be no difficulty in finding a suitable one. It should have a cover which closes tightly, be easy to get at in all its parts, work evenly, and be kept scrupulously clean. The simplest form of machine is merely a closed cylinder divided into two parts lengthwise by a set of parallel pipes, and capable of rotation on its axis, which is kept horizontal. The best material is iron, all inner parts being galvanized or tinned. The speed of rotation is from twenty to twenty-five turns per minute. The stuff is on one side of the pipes only, so that it is dipped into the benzine at every revolution, and can be taken out after it has been left to drain in the cylinder.

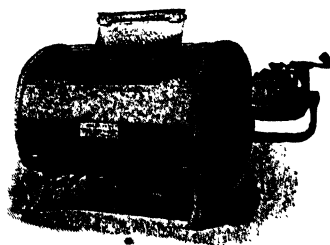


Fig. 2.

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A better form of machine, however, is a rotating cage, into which the goods are put. It turns inside a fixed cylinder containing the benzine, into which the lower half of the cage dips. The cage is divided lengthwise in the same manner as the rotating cylinder in the first machine.

Fig. 2 shows a power-driven washing machine. The

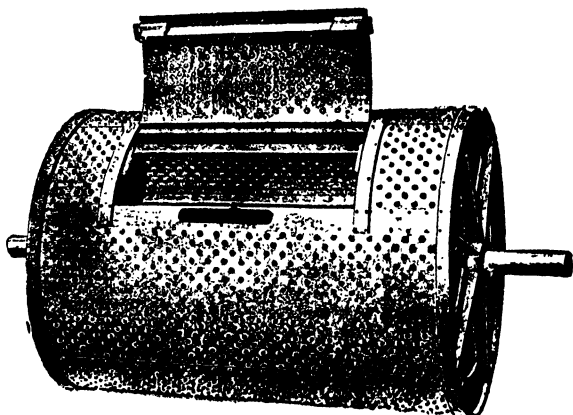


Fig. 3.

outside shell or tub is made of hard brass or galvanized iron of ample strength, riveted on cast-iron heads, the joints of which are planed and fastened together with bolts. These are made perfectly oil-tight. The tub is fitted with a sliding door and patent reverse movement. Only cut gears are used, all of which are protected by guards.

The cylinder or cage of the machine shown in Fig. 3 is made of No. 13 half-hard brass, riveted on to the

flange of the cast-iron spiders, which form the heads. The flange extends over the sheet brass, thereby relieving the rivets of the strain caused by the falling of the goods. The inside surface of the cast-iron spiders is covered with brass or copper. The special process of embossing the brass cylinder leaves no sharp edges to tear or damage the goods, as the ridge of the perforation is rolled over and forms a solid and smooth

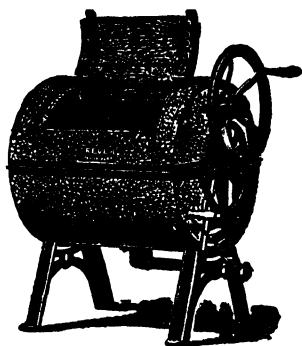


Fig. 4.

bead which adds strength to the plates. The hinges extend across the length of the door and serve to prevent the springing of the latter.

Fig. 4 shows a washing machine of similar construction for hand-power.

*Washing.*—If the goods are much stained or are specially dirty in places, all such stains or dirty places should be well brushed over with a concentrated benzine solution of benzine-soap. The benzine in the washing machine will not remove encrusted dirt or obstinate

stains unless this preliminary step has been taken, and goods which have been brushed over with benzine-soap in places must be allowed to lie for a time before going into the machine, so that the soap may have time to loosen the impurities sufficiently to enable the benzine in the washing machine to get rid of them altogether.

It is important from many points of view to shorten the actual benzine washing as much as possible. These points—the saving of time, labor, waste of benzine, etc.—are obvious enough, and it is especially obvious that the benzine-soap treatment just mentioned is most useful in this respect.

One or two other points may be mentioned. Small fragile articles should not be washed loose, but in muslin bags. Feather boas and feather ornamented articles generally must be tested before dry-cleaning to discover with what substance the feathers have been stuck on. If this substance is soluble in benzine it is naturally futile to attempt to dry-clean the goods, and if it is insoluble, care must be taken that the feathers are not torn off or damaged by the mechanical effect of the rotation of the machine. Mother-of-pearl must never be allowed to touch benzine, which destroys its lustre, so that buttons, etc., of that material must be taken off before the garment is dry-cleaned.

The lightest-colored goods are taken first and run from 20 to 25 minutes in the washer partially filled with fresh benzine. Care should be taken not to get too much benzine in the machine, otherwise the garments will float on the solvent and not get the dropping and rubbing that are necessary to free them from dirt.

This is followed by a rinse in a second machine with fresh benzine, while the darker goods go into the first machine without the benzine in it being changed. Or the rinsing may follow the washing in the same machine, removing the dirty benzine to the still for recovery. Benzine used once for rinsing may, as above mentioned, be used without purifying for the first wash for darker goods or dirty material.

The rinsed goods are lifted from the machine and taken to the extractor or centrifugal machine for the removal of the excess of solvent. The benzine thus extracted is allowed to flow back into a storage tank for future use. Provision for thorough lubrication of the extractor, especially when running at a high speed, must be made to minimize the risk of overheating. If the extractor is connected to the benzine tank, a gauze interceptor must be provided to prevent any flame passing down the pipes into the storage tanks.

There are many types of extractors, some being made with the driving arrangement underneath, and are known as under-driven extractors; this allows of employment of a tight-fitting lid. Others have all the working parts at the top of the machine and are known as over-driven extractors. The principle is, however, the same in all the machines, an inner perforated cage revolving at great speed in which the goods are placed. By the centrifugal action set up on the revolution of the machine, the solvent contained in the articles placed in the inner cage or basket is forced to the circumference of the cage, and finds its way through the perforations of the latter, and is conducted

away by the outer casing. In extractors practically no pressure is brought upon the goods, the pile of such goods as velvets and plushes is not injured in any way, so that they are in a fit condition for other treatment. The operation with extractors is very simple; all that

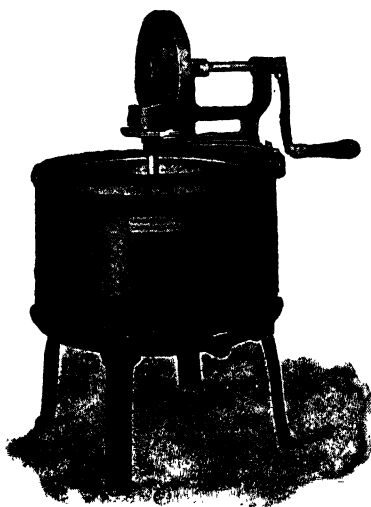


Fig. 5.

is necessary is to pack the goods well round the sides of the inner cage, taking care that the latter is properly balanced, that is to say, that one side does not contain a heavier weight than the other.

Fig. 5 shows a hand extractor, which can be easily converted into a power machine by slipping onto the crank shaft a pair of tight and loose pulleys. The

gears are accurate and practically noiseless in operation. The basket is suspended on steel ball-bearing, and is 24 inches in diameter and 14 inches high.

When the pieces leave the extractor they are almost dry, but in order to thoroughly free them from fumes they must air several hours in a warm room. This dry-room must be warmed by means of hot air or steam heat, direct fire being of course out of the question.

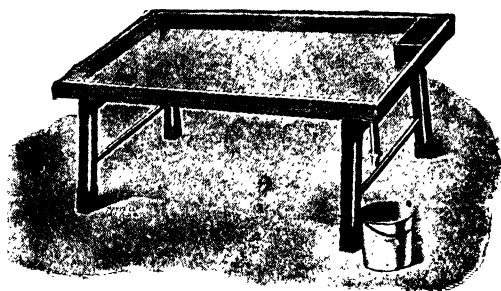


Fig. 6.—A Scrubbing Table

Of late years the drying tumbler has come into extensive use for drying garments and other articles that have been dry cleaned. Essentially this machine consists of a perforated cylinder designed to revolve inside of a shell of galvanized sheet iron. Beneath the cylinder are coils of steam pipes which furnish the heat for the drying operation. A fan located on top of the machine creates an air current which draws the heat through the garments and expels the vaporized gasoline to the outside of the building through a closed pipe.



Garments can be dried in this machine much quicker than in a dry-room. In addition, articles of heavy texture, such as blankets and heavy woolen garments, present a much better appearance after being so treated, as the tumbling which they undergo, together with the action of the heat, raises the nap and gives the fabric

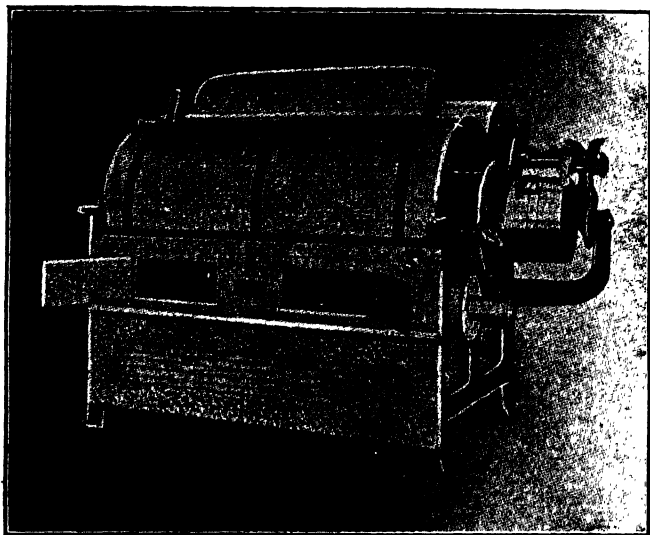


Fig. 7.—A Drying Tumbler.

a better feel. The machine is also used to dust and dry garments before they are placed in the washing machine.

In the above-described manner even rather dirty goods will be turned out in a faultless condition, and only in rare cases subsequent washing with soap

will be required. Even very dirty goods will often require only a final brushing with cold water after the evaporation of the benzine. It is, however, very important to remember that, if soap must be used, the temperature of the soap must in no case exceed 80° F.

White woolen and silk goods are brushed over with a somewhat weaker solution of benzine soap in benzine, and run for from 15 to 20 minutes in the washer. As regards silk, this is done on account of the greater danger of explosion, and wool readily turns gray, especially in damp weather and with fresh benzine. Benzine several times distilled is, on the whole, better for white goods than fresh benzine, the former being specifically lighter than the latter, and the goods turning out more beautiful the specifically lighter the benzine is.

White goods, after being well dried and brushed, and hooks and eyes, buckles and other sharp objects attached to them removed, are thoroughly washed in distilled benzine with a strong solution of benzine soap. They are then immediately rinsed twice in clean distilled benzine and extracted. They should not be run in the washing machine for more than 15 or 20 minutes. When thus cleaned, remaining stains are easy to remove and the goods turn out better than by dry washing after removing the stains. White uniforms and fancy costumes, if the lining and make-up permit, must sometimes be brushed off with weakly acidulated water and dried before being dry cleaned.

Colored silks, when very dirty and stained, sometimes cannot be properly cleaned by the dry process, and the then necessary wet cleaning should be preceded by a washing with benzine. When the silk is thus partially cleaned, the wet washing can be of a gentler character, and will be more rapidly effected, and the colors will suffer much less from it. One point which deserves special attention is the frequent occurrence of red stripes interwoven in the waists of ladies' blouses. These red stripes usually give up their dye to the benzine, whereby not only the silks, but everything else in the machine is ruined. Waist bands containing such stripes must always be removed from the garment before cleaning. Small articles are cleaned together in a coarse muslin bag, otherwise they are very liable to be lost. If a wet cleaning must follow the chemical treatment, make a lukewarm solution of a gall soap, or of a good neutral, olive-oil soap. Then spread the article on a clean surface—best on a slab of marble—and apply the soap to it with a soft brush, or if the silk is very fine, with a sponge. Work as rapidly as possible to lessen the chance of the color being affected, rinse thoroughly but expeditiously, and immediately afterwards place the silk in an acetic acid bath. Extract the articles rolled separately in calico. After drying dress with a solution of gelatine, and press.

Although by washing in the machine, most of the grease and dirt attached to the goods is removed, there are, as previously mentioned, frequently stains of paint, acid, fruit, etc., which are not affected or

removed by the benzine. It is, therefore, necessary to subject the goods to a thorough examination after they have been taken from the washing machine, and if stains are found, to remove them by special means, which will be referred to later on.

*Cleaning and renovating real velvet goods.* This kind of work constitutes a special department in cleaning establishments and will, therefore, be here discussed in detail. As a rule, goods of this class are injured by having been crushed or exposed to rain. The cleaner's office, therefore, is to remove the spots and other damages arising from these causes. The operation consists of two processes, namely, cleaning and steaming. First of all the velvet must be freed from dust, which is best accomplished by placing the article on a soft foundation and beating it thoroughly with an ordinary beater, such as is used for upholstered furniture, or dusting it in a tumbler. The article is next manipulated with a wire brush, special attention being given to particularly hard spots. When the article has thus been freed from dust, it is thoroughly rubbed with benzine, applied with a soft woolen rag, special attention being paid to the damaged parts. The brushing should always be in the direction of the nap. Velvets may also be cleaned in the ordinary manner in a washing machine, but the best authorities recommend both a dry and a wet cleaning. When wet cleaning very little soap should be used and the goods should be handled carefully. Silk velvets are dry cleaned in the ordinary manner, dried, and lightly sponged with an acetic-acid solution. Care should be taken when

## 54 DRY CLEANER, SCOURER, GARMENT DYER.

extracting not to crush the pile. Stains caused by oil, paint, tar, varnish, etc., which do not yield to the treatment with benzine or chloroform, are removed by covering them with butter or lard, allowing them to stand for some time, and rubbing again with benzine. The article is then dried with the assistance of heat, and rubbed, in the same manner as with benzine, with rectified alcohol, using a soft woolen rag and giving special care to spots caused by crushing and rain. Should there be spots due to corrosive substances, they should be treated with a mixture of alcohol and ammonia; but in case the color is not revived by this means, a little logwood and green vitriol (ferrous sulphate) must be used to restore it. The spots thus dyed are allowed to dry and are again brushed. Very dirty articles must be entirely cleaned with benzine.

When the velvet has been thoroughly cleaned, that is, clean to the backing, steaming may be proceeded with. This is done on the steaming-board, which is covered with a thick woolen cover, over which a soft linen cloth is drawn to prevent the steam from being too moist when it strikes the velvet. Care should be taken to use dry steam. The steam valves must close properly so that the flow of steam can be regulated at will. Everything being in order, the article is stretched smoothly over the steam-board, and a little steam being turned on, the damaged places are thoroughly scrubbed with a small sharp brush—a nail-brush will do—until they have been restored, after which they are brushed with a larger softer brush, in order to

remove gloss and the former brush marks, and to give the whole a uniform appearance. The steam is then allowed to flow in with greater force, but the article must not become too hot, so that after closing the valve, it will not become moist by the condensation of the steam. Good light is a special requisite, and the work should be done in a place free from all draught, for a single cold draught of air is sufficient to spoil all. If, however, notwithstanding every precaution, an article becomes damp, it must at once be dried and the process repeated. Every portion of a ripped garment as well as every part of a whole article should be secured with pins so that no shifting can take place. When all the stains have been removed, the articles are exposed to a heavy flow of steam for the purpose of equalizing the whole. Whole velvet jackets are for this purpose hung upon broad hangers so that the sleeves are well spread out, and care should be taken not to touch the articles while still warm or damp.

Articles which may have become dull may be rubbed with a soft woollen rag moistened with oil dissolved in benzine, but this must be done very carefully and uniformly.

These directions, if carefully followed, will insure success, but the work is not so easy as it looks on paper; dexterity and care are both necessary, and a certain routine is only acquired by practice.

Large establishments have specially constructed velvet-steamers. Such an apparatus is so constructed that owing to interior partitions, the water must ab-

solutely separate from the steam. In addition, the steam-pipe is provided with a discharge pipe for the condensed water. The steamer is constructed of copper and enclosed on all sides, so that the steam can escape only in front, where it is to act.

After having been cleaned the article is most suitably steamed by not taking too large a surface at one time, but steaming a portion thoroughly, brushing with a hard brush from bottom to top, and repeating brushing and steaming until the velvet shows a uniform appearance. When thus the entire surface of the garment has been uniformly treated, a gentle flow of dry steam is again passed through. Finally, the garment is brushed from top to bottom. By this process velvet and plush are made to look like new.

Every velvet article must be treated according to the special circumstances of the case, and it may happen that the cleaner has a number of garments, of which no two can be treated in exactly the same manner. White silk velvets are frequently best cleaned by wet washing and bleaching. Pressed velvet blouses require a special treatment. Very small stains should be damped and removed, if possible, by careful use of the finger nail, taking care not to work against the nap. In brushing, care must be taken not to injure the pattern; and the steaming before the final brushing with a soft brush must be very slight indeed.

In removing stains from *ladies' cloth coats*, care must be taken not to make them too wet. There is of course extra risk of doing so if the stains are numerous or obstinate. The luster suffers by over wetting,

and it is impossible to restore it by hand ironing. Rain stains are very common on such garments, and are best removed by ironing them under a damp cloth, between which and the stain must again be laid a dry cloth, so that only steam reaches the stain which is then absorbed by the dry cloth. Dust stains on silk are removed by benzine, as the use of water merely substitutes a water stain for the original mark.

*Dry cleaning carpets.* The processes to be selected in carpet cleaning depend on the size of the carpet, on the way in which it has been dyed, and on the degree of dirtiness. Unskillful cleaning often results in making the carpet quite worthless. It cannot be expected that all the colors in a many-colored carpet should be fast to washing, and it constantly happens that dark patterns bleed on to a light colored ground.

If a carpet is obviously unfitted for wet washing it must be dry cleaned. This requires very large washing machines, holding several hundred gallons of benzine. However, a carpet not too dirty can be cleaned by first freeing it from dust by beating, running in a dust wheel, or, better, by the vacuum process. It is then spread out upon a floor and rubbed, section by section, with a linen cloth tightly rolled together and soaked in benzine and benzine soap. This will freshen the colors and clean the carpet. Weak acetic acid may also be applied, and the carpet then dried and steamed. Carpets that have been dry cleaned in a washing machine must be resized. This is done by tacking the carpet face down on the floor, taking care to keep the edges straight and at right angles to each



other, and applying glue to the under side with a brush. The glue should be applied hot and in limited quantities, so that it will not soak through to the nap. Special preparations for sizing carpets and rugs are now on the market and seem to give better results than glue.

Following are a few general hints on cleaning the various articles that find their way to the dry cleaner. The cleaner should bear in mind that the methods advocated are those generally followed in everyday practice and that they do not apply in all instances. No definite rules can be laid down for cleaning any article or class of wearing apparel and the method that is used must depend entirely upon the particular conditions existing, the state of uncleanness of the article, the dye with which it is colored, and the amount of wear and service it has undergone.

*Men's Garments.* As a rule, men's garments can be cleaned in a satisfactory manner by the dry process, although quite often garments will be met with that are so soiled that they can be put in good condition only by wet cleaning. Here, again, no hard and fast rule can be laid down governing all cases, and the cleaner must use his best judgment as to which method will give the best results at the least expense. Men's garments that are to be dry cleaned should be well dusted and dried, placed on a scrubbing table and gone over thoroughly with a brush dipped in a benzine soap solution. They then may be placed in the washer and washed in the ordinary manner without the addition of soap to the benzine other than that contained in the articles as a result of the brushing. When the

washing in benzine is completed the garments should be put through one or more rinses of clean benzine, extracted and dried. Dark garments may be washed in clarified or settled benzine. White garments should be washed only in distilled solvent.

*Hats and caps*, with the exception of straws and panamas, may be dry cleaned in the same manner as men's garments.

*Raincoats* are generally so soiled that they cannot be cleaned satisfactorily by the dry method and, as a rule, it is necessary to wet clean them. No coat or other article containing rubber in its make-up should be placed in benzine, as benzine dissolves rubber.

*Overcoats* are seldom wet cleaned. When treated in the same manner as outlined above for men's garments the results are satisfactory.

*Sweaters and knit goods* may be dry cleaned, but better results may generally be had by the wet method. White and light-colored sweaters should be dry cleaned only in new or distilled benzine.

*Women's woolen suits and dresses*, as a rule, are best cleaned by the dry method. Nor is a preliminary brushing with a solution of benzine soap necessary in the very large majority of cases, although the condition of the particular garment must dictate the procedure in this respect.

*Silk dresses*, especially if decorated with fancy trimmings, must be dry cleaned. If a garment of this nature is badly soiled the trimmings must be removed and the wet cleaning resorted to in the manner described in the chapter, "Wet Cleaning."

*Lace* can seldom, if ever, be cleaned in a satisfactory manner by the dry method.

*Slippers of satin* are easily dry cleaned. They should not be immersed in the cleaning fluid, as in this event the coloring matter in the soles is very sure to run, and some of the color will be transferred to the tops. The satin should be sponged with a weak solution of benzine soap, without touching the soles, and rinsed with a sponge dipped in clear benzine.

*Blankets and lace curtains* are best wet cleaned as described under the chapter devoted to wet cleaning.

*Upholstered furniture.* The upholstery on furniture may be dry cleaned by brushing it with a benzine soap solution and then sponging off with clear solvent.

*Silk plush* is best dry cleaned when no soap is added to the benzine. When the cleaning operation is completed the luster of the fabric should be heightened by rubbing with a woolen rag dipped in a mixture made up in the proportion of 1 pint of benzine, 1 pint of ether, and  $\frac{1}{2}$  pint of alcohol. The rubbing should be in the direction of the nap. The plush is finished by steaming with a hose or over a steam-board.

*Colored charmeuse silk* should be dry cleaned, never wet cleaned. The white fabric may be wet cleaned without danger of damage. When spotting this material little if any rubbing of the spot should be done, otherwise a light spot will appear that cannot be removed.

*Portières* may be dry cleaned, but never in a washer containing other goods. These articles give off much lint which, if it settles on other articles, is very diffi-

cult to remove. An addition of soap to the benzine is not necessary.

*Tussah silk* cannot be dry cleaned, a wet cleaning being necessary to give satisfactory results.

#### PURIFICATION OF BENZINE.

It is of the greatest importance to every dry cleaner to recover as much as possible of the benzine which he has employed for removing dirt and grease so that it can be used again for the same purpose. Many methods for doing this have been proposed, and a few of them will here be described.

*Filtering.* The benzine is filtered in succession through sand, charcoal and flannel. A suitable filtering apparatus consists of a zinc drum from 40 to 50 inches high and 13 to 14 inches in diameter, provided with a closely fitting cover and with a conical lower end. At the bottom of the cylindrical part of the drum is a perforated plate to support the filtering medium, which consists of a felt layer about one and a half inches thick, covered with clean sand, which is itself covered by coarsely powdered animal charcoal or well burnt wood charcoal. A tap at the bottom of the conical drum admits the withdrawal of the filtered benzine. The felt must be washed from time to time, and fresh sand and charcoal put in. While filtered benzine is not sufficiently colorless for use on light colored articles, it answers very well for those dyed with dark or medium shades.

*Purification of benzine with sulphuric acid.* The benzine is compounded with dilute ( $\frac{1}{4}$  to  $\frac{1}{2}$  per cent.) sulphuric acid and allowed to stand quietly for 24 to 36 hours, when it will be sufficiently clarified and can at once be used. Although benzine so purified can be used without disadvantage for all silk and all wool grades, the acid which it retains makes it extremely destructive of all cotton fabrics, so that it is inadmissible even with silk or woollen goods, if they are lined with cotton. This destructive action comes on with time in any case, but immediately if the articles are ironed.

This drawback may, however, be remedied by the following process: Bring the benzine into a large earthenware vessel, and while stirring constantly, mix it with sulphuric acid in the proportion of one quart of acid to 100 quarts of benzine. Allow the mixture to stand quietly for from 24 to 48 hours. If, however, the benzine is to be used the next day, draw it off carefully into a lead-lined, sheet-iron vessel and mix it with one pound of lime powder, obtained by slaking ordinary lime; the powder should be perfectly dry. In about 12 hours all the dirt and lime will have settled on the bottom of the vessel. The benzine is then drawn off through a tap placed about four inches above the bottom of the vessel. Benzine thus purified has an odor different from that of the fresh or distilled product; the odor, however, disappears immediately on drying. The benzine is not perfectly water-white, it showing a yellowish tint; but it can without hesitation be used for goods of dark and light colors, including silk. Even white garments turn out perfectly clear if, after washing

with the clarified benzine, they are rinsed in fresh benzine.

The method of clarifying benzine invented by Hasselbach is said to yield very satisfactory results. It consists in mixing the benzine with from 1 to 2 per cent. of its weight of concentrated sulphuric acid, the quantity depending upon the amount of dirt in the benzine. The mixture of benzine and acid is well shaken and allowed to stand until it has completely separated into two layers. The upper layer of benzine is then decanted and mixed thoroughly with 1 per cent. of its weight of the following solution: Alum, 20 oz.; acetate of lead, 12 oz.; sulphate of magnesia, 5 oz.; sulphate of soda, 5 oz.; water, 10 gallons. The mixture is allowed to stand and decanted from the precipitated lead sulphate before use. The acetate of alumina eventually present throws out all the fatty acids from the benzine. The soluble sulphates make the liquid heavy, so that the purified benzine will rise to the surface, whence it can be drawn off for further use.

*Deodorization of benzine.* Dissolve in the badly smelling benzine about 1 to 2 per cent. of its weight of a free fatty acid. Then add about  $\frac{1}{4}$  per cent. of tannin and mix intimately. Finally add sufficient soda or potash lye, eventually also milk of lime, to saponify the fatty acid and neutralize the tannin, and shake repeatedly. After some time the milky fluid separates into two layers—a salty, saponaceous slime on the bottom and supernatant clear benzine almost free from color and odor. This benzine, when decanted and filtered, may be at once used for many

technical purposes, and when distilled yields an excellent and pure product. The fatty acids of tallow, olive oil, or of other fats and oils, may be used for the purpose, but they should show but little odor of rancid fat. Oleic acid may also be employed, but it must previously be shaken with a  $\frac{1}{10}$  per cent. soda solution to get rid of the badly smelling volatile fatty acids, especially butyric acid.

*Purification of benzine by distillation.* The best, and in fact only satisfactory process for the recovery and purification of benzine as yet known, is distillation. In proper hands the distillation is not only perfectly safe, but it wastes less of the benzine than any other purification process. In clearing benzine with sulphuric acid or benzine powders, the organic dirt particles undergo a change by which the dirty gray coloring turns clear and yellowish, but a perfectly colorless fluid which could be safely used for cleaning white or light-colored articles is not obtained. Besides, it is doubtful whether the benzine thus cleared possesses the strength and power belonging to fresh or distilled benzine. Benzine cleared by repeated filtering will certainly lose the greater part of its dirt, but none of the grease and soap absorbed by it. Benzine cleared in this manner will also not be perfectly colorless, although it is much better than that cleared with sulphuric acid.

Any one having doubts on the subject should convince himself by making a trial of the two methods. For instance, light clothes washed in benzine cleared with sulphuric acid, never look clear and fresh. In

proof of this, take a dress and wash the skirt in fresh or distilled benzine, to which has been added a small quantity of benzine soap, and then wash the waist in benzine cleared with sulphuric acid, to which likewise a little benzine soap has been added. The difference will at once be apparent, for while the skirt will be perfect, the waist will have a grayish yellow tinge.

No matter whether a cleaning establishment be large or small, a distilling apparatus should be one of its appointments. The small quantity of steam needed for distilling can be provided by a small steam generator, in case other power is wanting. These steam generators are chiefly used where no more than one-half atmospheric pressure is required, as for steaming, distilling, dyeing, and the like. They have a wrought-iron fire-box, require little fuel, and are at the same time economical and most satisfactory. They take up little room because they need not be walled in, and can be set up in any place possessing a chimney.

In designing a plant for collecting and redistilling dirty benzine there are always three prominent considerations: Safety from fire and economy of labor and benzine. Much may be done in the way of saving distilling by having five or six receptacles for taking the benzine run out of the washing machine. One of these receptacles receives the benzine that has been used in the actual cleaning, the others taking the separate rinses.

By working with a large quantity of benzine the first two or three of these receptacles, beginning with



that containing the dirtiest benzine, can always be allowed time to settle. The bottoms of the receivers being funnel-shaped with a tap in the neck of the funnel, the sediment can be let out with a minimum of benzine, and all these sediments can be run into the still, the clear supernatant benzine going back to the washing machine.

Thus the amount requiring distillation is reduced to a minimum, and the expensive and always more or less dangerous process is carried out on a much smaller scale than usual, thereby saving in distilling plant, in time, in fuel, and in risk.

If necessary, benzine can be pumped out before the settlement of the mechanical dirt is concluded, but then the lower end suction pipe must be protected by a filter or strainer of some kind, and should not be brought too near any sediment that may have formed. It is always best to wash and rinse with plenty of benzine, divided, however, in several lots. In this way the danger of having too much dirt in the receivers at a time is obviated, and if the apparatus is well planned and set up and used in a workmanlike manner, there will be no fear of any serious loss by evaporation, or by valves and cocks getting choked by sediment.

In purifying benzine by distilling, care should be had not to fill the apparatus above the mark indicated on the gauge, and in the commencement of distillation to regulate the steam, so that the benzine runs off cold and water-clear from the condenser. High temperature in the heating elements is quite

desirable in distillation and steam at above 80 pounds pressure is, therefore, to be recommended.

Fig. 8 shows a practical benzine distiller. It is composed of three principal parts: The kettle for the reception of the dirty benzine; the condenser in which the benzine vapor is cooled off, and the divider through which the distilled benzine flows out.

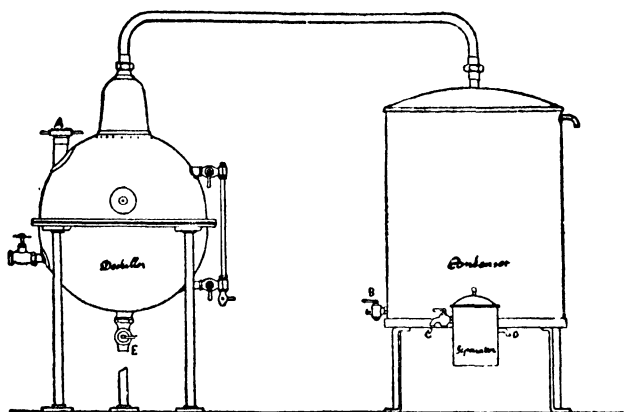


Fig. 8.

The apparatus is filled with the dirty benzine up to the mark indicated on the gauge, through the hole *A*, which is hermetically closed after the filling. Steam is then gradually introduced, and the cold-water cock *B* turned on, the still being then in working order. The benzine flows through valve *C*, while the water separated from the benzine has its outlet through the pipe *D*. After the benzine ceases to flow the steam is shut off and the valve *E* opened so that

the dirt residues may run out. By this process the apparatus actually cleans itself, and no benzine is lost.

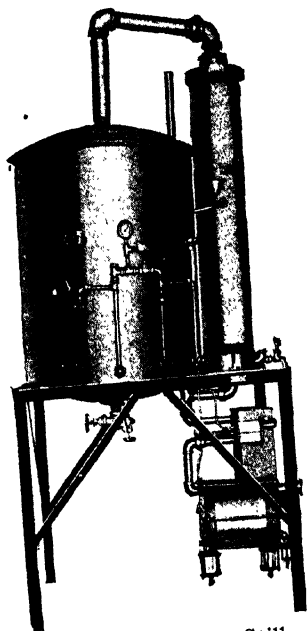


Fig. 9.—Gasoline Still.

The still shown in Fig. 9, manufactured by the Bousman Mfg. Co., of Grand Rapids, Michigan, is stoutly constructed and highly efficient. It is supplied in either heavy copper or electrically welded tank steel. The entire machine is built upon one stand, and is designed to occupy small floor space. The vaporizers are insulated and the heating elements are so constructed that great efficiency is had in vaporizing, and the multitubular condenser proves very

effective. A dry solvent is delivered directly from the machine by the use of a device known as the Auto-filter. It consumes a comparatively small amount of steam in consideration of the work done. A high pressure, though desirable, is not necessary.

*Clarification of benzine by centrifugal force.* A very efficient, cheap and simple means of clarifying dirty benzine is offered by the centrifugal clarifier. In appearance this machine resembles the cream separator; in fact it works on the same principle and was first placed on the market by a large manufacturer of these latter devices. This method of clarifying benzine has so many advantages over the older and more cumbersome methods that it has met with universal approval of the large majority of the cleaners of the country. In construction the machine is very simple. It consists merely of a cast-iron casing or housing inside of which is suspended a drawn-steel bowl of small diameter, and about three feet long. This bowl is revolved at a very high speed. The gasoline to be clarified enters the bowl at the bottom. The centrifugal force exerted by the revolving bowl acts on the heavier particles of foreign matter in the benzine, holding them to the sides of the bowl, while the gasoline passes through and out at the top. The action of the machine is rapid and any given quantity of benzine may be used over and over the same day, doing away with the necessity of keeping a large quantity of the solvent on hand in storage. The benzine delivered by the clarifier is of a yellowish color and cannot be used for cleaning white and delicately colored articles, but serves

the needs very well for the darker colored ones. The machines are driven both from a belt and by a small steam turbine located at the top of the machine and

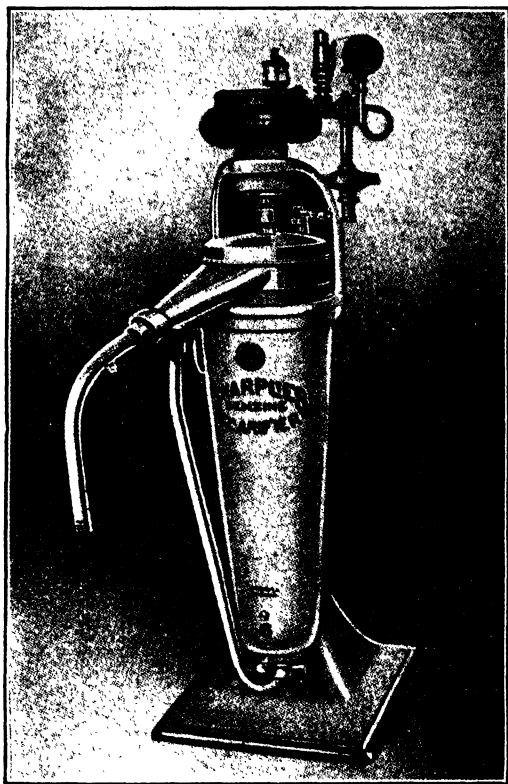


Fig. 10.—Centrifugal Benzine Clarifier.

connected directly to the shaft of the bowl. The machine shown in the accompanying illustration, Fig. 10, is of the latter type.

## II.

### REMOVAL OF STAINS, OR SPOTTING.

THE process to be adopted for removing stains will largely depend on the material of which the textile fabric is made, and also whether it is dyed or not dyed, and on the character of the stains themselves. The latter may be broadly divided into two classes, *viz.*: Stains of a fatty and non-fatty nature. Besides, there have to be taken into consideration stains which destroy the color, and those which have no effect upon it. In the former case the stain itself may be readily removed, but sometimes it will be impossible to restore the impaired color. The first thing is to find out what has caused the stain. If no conclusion can be reached on this point, the cleaning agents it is proposed to try must be tested as to their action on the dye on some part of the garment which is invisible when it is worn, or at any rate where change in the dye would be likely to escape observation. This must be done before the stains in a conspicuous place are meddled with.

It must be remembered that every failure to remove a stain increases the difficulty of dealing with it, and one of the chief troubles of the professional cleaner is

with stains which the owners of the garments have themselves tried in vain to get rid of.

The tools required for the removal of stains consist of tampions, some pieces of buckskin, 2 brushes, one large and one small, a marble or glass slab, sponges, spotting sticks for daubing the spots, one rice fiber brush, two small pans, one for distilled water and the other for soap, and chemicals. A glass slab is to be preferred to a wooden board, because it does not stain, is readily cleaned, and is not attacked by chemicals. Small hard-wood boards rounded off on both sides, which, if necessary, may be pushed into sleeves, etc., are also very useful.

The nature of the agents employed must be sufficiently understood to make a success of the operation. Thus, for instance, a rust-stain in linen or another fabric cannot be removed with ammonia, or a stain in cloth due to copal varnish, with dilute alcohol. Rust consists of hydrated ferric oxide which is insoluble in ammonia, and copal varnish does not dissolve in dilute alcohol. Hence, for the removal of rust an agent has to be employed which enters with the hydrated ferric oxide into a soluble combination that can be removed by washing with water. For cleaning cloth stained with copal varnish, an agent capable of dissolving copal has to be used, and since the latter is not soluble in dilute alcohol, and even not in cold rectified 95 to 96 per cent. alcohol, this agent is useless for removing such stains. It has to be borne in mind that fat copal varnishes are prepared by boiling the melted copal with linseed oil or by

treating the copal with a mixture of turpentine and linseed oil; on the other hand, copal lacquers are obtained by dissolving melted copal in a mixture of alcohol and ether or chloroform, benzol, etc. By one of these solvents of copal, or a mixture of them, the copal stains may be removed.

The removal of stains from undyed goods is accomplished with comparative ease, the use of a suitable solvent sufficing in most cases. However, in the treatment of dyed goods it has to be taken into consideration whether the dye is soluble or insoluble in the solvent or other agent to be used for the removal of the stain. In the first case, *i. e.*, if the dye is soluble in the cleansing agent, special precautions have to be observed in removing the stain.

In treating *woolen fabrics*, *i. e.*, various kinds of cloth and cloth-like tissues, furniture damask (also that mixed with silk and cotton), velvet-like fabrics (plush), carpets (velvet, tapestry, etc.), potash or soda lye, concentrated ammonia and hot solutions of alkaline carbonates cannot be employed for the removal of dirt or grease stains.

The wool fiber is attacked even by dilute soda and potash lyes, and also by solutions of alkaline carbonates (soda and potash) if used at a temperature of above 122° F. By cold moderately strong ammonia and cold dilute solution of soda or potash, wool is scarcely attacked directly, but it is attacked by concentrated ammonia even if exposed to its action for only about three minutes. Even dilute ammonia may in a short time exert an injurious effect upon the wool



fiber. *However, carbonate of ammonia has scarcely any effect on sheep's wool.*

On the other hand, wool is very resistant to dilute acids, and may even for some time be boiled in water compounded with acid (acidulated water) without suffering a change.

The use of caustic alkalies, mineral acids—except dilute hydrochloric or other fabric-destroying agents, is not required in spotting operations. Any acid action required is obtained in a harmless form by the use of organic acids such as acetic, or formic; and alkaline action by means of dilute ammonia, or a solution of borax. While these acids or alkaline agents have no detrimental action on cotton, wool or silk fabrics, they should be used with care, particularly the alkalies, when working on colors.

The lustre of silk fabrics is impaired by the action of alkalies other than sodium carbonate (washing soda) in cold dilute solution, borax, and weak ammonia. Dilute sulphuric acid does not exert an injurious effect upon silk or wool fabrics when rinsed out after using in wet-cleaning or dyeing operations. Organic acids have no injurious action even when not rinsed out; in fact, acetic or formic acid is often purposely left in silk to impart scroop.

No acid should come in contact with black silk, and water scarcely with colored silks, because the better qualities of black silk are even at the present time mostly dyed with logwood, and colored silks yield coloring matter to water. Rubbing or scratching of any kind produces dull spots, and silk fabrics

should, therefore, be cleaned only with a sponge or not too hard a brush.

As regards *cotton goods* (calico, cambric, percale, jaconet, rep, dimity, twill, piqué, cotton velvet, etc.), it may be mentioned that the cotton fiber is scarcely attacked by dilute acids, for instance, hydrochloric acid; acetic acid has no effect upon cotton whatsoever.

Cotton will stand the action of cold dilute potash or soda lye. Cold concentrated solutions (20° to 30° Bé.) of caustic potash or caustic soda, however, produce a chemical change, the cotton shriveling up.

By *linen* is generally understood fabrics consisting either of pure linen or half linen (linen-yarn warp and tow-yarn woof); also half-linen and half-cotton goods in which the warp is formed of linen and the woof of cotton. Since the cleaned flax fiber consists chiefly of cellulose, yet on account of its large content of lignine cannot be classed with the cotton fiber, linen goods will, generally speaking, stand the same treatment as cotton fabrics. From the finer qualities of *jute* tissues are made which serve for the manufacture of curtains, carpets, and furniture coverings, they being well adapted for this purpose by reason of their luster. The *jute fiber* consists of cellulose with bastine, the so-called corchorobastose, which is readily decomposed by acids and in general very sensitive toward chemicals. This deserves particular attention in chemically cleaning such goods.

White goods are most readily cleaned with soap and water. In difficult cases, chlorine and other similar bleaching agents are employed. Soap is also an ex-

cellent agent for removing stains from colored fabrics, provided the dye is fast. For shaped or trimmed articles it is, however, best not to use it, or at least very sparingly.

Many stains can be removed with water. The principal requisite is to use only distilled or soft water, otherwise a white ring is formed around the stain which has been treated, and this ring does not disappear. Spread the article upon the glass plate, moisten a brush with soft water and brush the stain until it is no longer visible; then dry with a piece of buckskin, as otherwise the water will form rings, especially with light-colored articles. The treatment is rendered more efficient by adding to the water a little salt for white goods, and for colored ones, a little spirit. For silks as much spirit is added as can be done without affecting the dyes. Goods also dry much faster when spirit has been added to the water.

From the explanations given above, general conclusions may be drawn as to the methods to be adopted for the removal of stains. To recapitulate what has been said, the operator should first of all be thoroughly conversant with the properties of the cleaning agents, whether in liquid, solid or pasty form, and particularly as regards their solvent power and chemical action. Due consideration must also be given to the effect which the cleaning agents may under certain conditions exert upon dyed goods, and, finally, before commencing the operation, it has to be considered whether the fabrics to be cleaned may be injured by the agent selected.

The object of dry-cleaning garments and other articles is to remove as much as possible all stains, whether of a chemical or mechanical nature. However, notwithstanding this washing with benzine, the articles, after drying, may still contain certain stains, partly of vegetable origin, for instance, from fruit and vegetable juices, partly of animal origin, such as blood, fat, secretions, etc., and finally, also stains formed in consequence of a chemical decomposition. Such stains have to be removed from the garments and other articles, and sometimes this may be effected without previous chemical washing.

The principal spotting agents, including those introduced in recent times, are given below. The chemicals should be absolutely chemically pure, otherwise it may happen that in removing one stain a new one may be produced.

*Acetone.* This useful solvent is a volatile inflammable liquid of a peculiar, but not disagreeable, odor. It is one of the few volatile liquids that will form clear mixtures with water, and also with gasoline and other volatile solvents. As a solvent acetone serves many of the purposes for which the more expensive chloroform, ether, carbon tetrachloride, and other substances are often employed, and compared with these it is a particularly agreeable liquid to work with. It will not damage fabrics and rarely affects colors. Acetone is one of the best solvents known for varnish, tar, pitch or resin; mixed with an equal volume of benzol, it is an excellent solvent for paint stains.

*Ether.* Pure ether is a colorless, very limpid fluid,

of a peculiar, penetrating odor, and at first a very pungent taste; the after-taste is cooling, and should not be bitter. Ether is extraordinarily volatile, boils at from  $93^{\circ}$  to  $95^{\circ}$  F., and burns with a bright yellow flame, yielding water and carbonic acid. Its vapor mixed with a large quantity of air, if ignited, explodes with great violence. In consequence of this property and the great density of its vapor, extreme care should be exercised in handling ether, or manipulating with it in the vicinity of a flame. The latter should *never* be done if it can possibly be avoided, nor should the ether be allowed to stand in a warm room. Ether is miscible in all proportions with spirit of wine, but not with water, which dissolves one-tenth its volume. The presence of water and alcohol is detected by mixing the ether with an equal bulk of carbon disulphide, which should result in a perfectly clear liquid; a piece of potassium kept in the ether for 24 hours becomes coated with a yellowish film, and imparts a yellowish color to the liquid if alcohol be present. Aniline-violet is insoluble in absolute ether, but in the presence of 1 per cent. of alcohol colors the liquid distinctly. Ether is an excellent solvent for fats and resins. It is used at the commercial strength.

*Chloroform.* This is less dangerous than ether. It is a limpid, colorless, diffusive liquid, not inflammable, of an agreeable ethereal odor, a hot saccharine taste, and a neutral reaction. In a perfectly pure state it is difficult to keep, and hence some alcohol is added, so that its specific gravity varies between 1.488 and 1.492, and its boiling-point is in-

creased to 149° F. When brought upon the skin chloroform evaporates rapidly, with the production of a cold sensation.

When chloroform is shaken in a perfectly clean glass-stoppered vial with an equal bulk of sulphuric acid, no color should be imparted to either liquid after remaining in contact for 24 hours. Should a coloration appear, the chloroform is not pure. If 5 centimeters of purified chloroform be thoroughly agitated with 10 cubic centimeters of distilled water, the latter, when separated, should not affect blue litmus-paper (absence of acids), nor test-solution of nitrate of silver (chloride), nor test-solution of iodide of potassium (free chlorine). It is used principally to remove grease spots. Stains of this nature which resist other solvents will frequently yield to chloroform. It is used at the commercial strength.

*Alcohol* is a colorless, very mobile fluid and possesses a characteristic odor and taste. When exposed to the air in a thin layer, it evaporates rapidly without leaving behind a residue. It is very inflammable and burns with a non-luminous blue flame. It is miscible with water, ether and chloroform and gives clear mixtures with the majority of volatile oils. Pure alcohol dissolves either entirely, or partially, fat oils, fats and many resins. It is also a solvent for numerous organic and inorganic compounds (salts, alkaloids, etc.).

To increase the efficacy of alcohol as a spotting agent, benzine soap is dissolved in 98 per cent. alcohol. The alcohol may also be mixed with ether.

chloroform, etc., and with the soap solution, this mixture being used for spotting. It may here be mentioned that generally speaking a mixture of two, or even several, solvents is more effective than when one solvent is used by itself. This applies particularly to solvents acting in the same manner.

*Acetic ether* boils at  $170.6^{\circ}$  F., and smells of cider. Its specific gravity is 0.91. It mixes readily with alcohol and ether, and is useful as a solvent.

*Ammonia*. This is one of the most important agents for the removal of stains. It forms a colorless fluid, with a strong, penetrating odor and a pungent, acrid taste. When highly concentrated it reddens the skin and produces blisters. It imparts a brown color to tumeric-paper, a blue color to red litmus-paper, and a green color to the juice of violet flowers.

When shaken with an equal quantity of lime water, it should yield a clear, or at the utmost slightly turbid, fluid, otherwise it has been in contact with air and absorbed carbonic acid from the latter. Empyreumatic products are recognized by the dark coloration, as well as by the odor, which appears on heating the fluid previously slightly acidulated with sulphuric acid.

In commerce ammonia is generally sold according to degrees of Baumé. For removing stains the product of  $18^{\circ}$  to  $20^{\circ}$  Bé. suffices.

Ammonia suitable for cleaning purposes should evaporate at the temperature of boiling water without leaving any residue. When using it for the removal of stains it should first be ascertained whether

any of the colors suffer a change by it. It should be used in a ten per cent. solution for spotting.

*Benzine* has been previously described. Stains of resins and grease are rubbed with benzine soap solution, and then well rinsed in benzine. The cleaning efficacy may also be increased by the use of a mixture of benzine and benzol in place of benzine by itself, these two spotting agents acting in a similar manner.

To increase the efficacy of benzine for the removal of stains, mixtures of benzine with rectified turpentine, alcohol, etc., are prepared. Such mixtures should, however, only be used when perfectly clear, they being unfit for the purpose when turbid. In clear mixtures benzine soap dissolves completely, and with such benzine soap solutions grease stains of all kinds, resin and asphalt stains, etc., can be removed.

Stains of greases, gravy, glue, and axle grease, are removed by treatment with warm benzine soap solution and subsequent rinsing in benzine.

Besides the above-mentioned mixtures, carbon tetrachloride and chloroform are also used for the removal of stains of tar and oil paint. Thus, for instance, tar stains in white goods are easily and completely removed by a mixture of chloroform and tetrachloride. The same effect is also produced by first brushing the stains with carbon tetrachloride, and then treating them with benzine.

*Carbon tetrachloride* has been previously described. It is a solvent for oils, fats, wax, paraffin, stearin, varnish, lacquer, shellac, asphalt, pitch, resins, balsams, tar, gutta-percha, rubber, soda and potash soaps.



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It is non-explosive, and for use in spotting it possesses the important property of not attacking the dyes of the tissues. It is used at full commercial strength and leaves no marks or stains.

In addition to stains originating from the above-mentioned substances, carbon tetrachloride is an excellent spotting agent for the removal of stains caused by butter, milk, gravy, oil, paint (even old oil paint stains). It is further suitable for the removal of tar, train oil, and axle grease stains. It is equal to chloroform as a solvent for oil paint, though it is better to use for this purpose a mixture of it and chloroform. With such a mixture the last traces of oil paint as well as of tar, can be removed even from white goods. In spotting with carbon tetrachloride no rings are formed, as is the case with other spotting agents, and it is, therefore, particularly suitable for spotting light-colored goods. A mixture especially suitable for dissolving and easily removing stains of red varnish, etc., is sometimes used. It consists of: Carbon tetrachloride and acetic ether, each 1 part, and rectified fusel oil, 2 parts.

For spotting, a clean rag, a tuft of wadding, or a small sponge is moistened with carbon tetrachloride and the stain gently rubbed and eventually dabbed until it has disappeared. The rag or tuft of wadding should be frequently renewed and sufficiently moistened with carbon tetrachloride.

If there is danger that even with the most careful rubbing the article might be injured, fold a sheet of white blotting-paper together about four times, soak

it with carbon tetrachloride, place the stained article upon it, and cover the stain with the same thicknesses of blotting-paper. Then press firmly, best with a cold smoothing iron, the upper layer of paper upon the lower, whereby the stain between the two layers of paper is dissolved and its substance absorbed by the solvent. Repeat the operation until the stain has entirely disappeared. To moisten the stain with carbon tetrachloride and then rubbing dry with a rag is a wrong way of spotting, since the substance already dissolved is thereby spread out to a greater extent and a larger stained place with a plainly perceptible edge is formed.

*Acetic acid.* This increases the efficacy of alcohol, benzine and ether in many cases.

Acetic acid occurs in commerce in various degrees of purity and strength. For our purposes chemically pure acid can only be taken into consideration, and it should especially be free from empyreumatic substances. The degree of acidity is of minor consideration, since too strong an acid can be readily reduced by the addition of water.

Acetic acid is a colorless fluid of a peculiar pungent taste, and when applied to the human skin causes redness and swelling, followed by paleness of the part. Prolonged application is followed by vesication and desquamation of the cuticle. At the ordinary temperature acetic acid evaporates perceptibly; it boils at  $244.4^{\circ}$  F. Acetic acid neutralized with pure carbonate of soda and diluted with water should not be changed by potassium permanganate solution.

Acetic acid is used, diluted with water, for remov-

ing stains caused by alkalies and for livening up colors injured by street dust, especially on ladies' skirts. The goods are afterwards rinsed with clean water. Care must always be exercised in using acetic acid on dyed goods, in which case a 5 per cent. solution should be used.

*Fusel oil.* This is an excellent solvent for varnishes, oil-colors and resins. The smell of it is got rid of by airing the cleaned articles.

*Glycerin* is a syrupy liquid having the specific gravity 1.28 at 59° F. It is transparent, colorless, inodorous, very sweet, and somewhat warm to the taste, oily to the touch, without action upon litmus, and soluble in all proportions in water and alcohol; also in spirit of ether, but not in ether, chloroform, benzol, fixed oils, or volatile oils.

Glycerin is a solvent for alkalies, coffee, chocolate, dye-stuffs, and other bodies. It also serves for finishing fine fabrics, etc. It is not inflammable and is used at the commercial strength.

*Borax.* Borax forms large, colorless, monoclinic prisms, which are transparent, inodorous, have a mild, sweetish, cooling, and afterwards alkaline, taste, and in dry air effloresce superficially and become opaque. It is soluble in 12 to 15 parts of cold, and in 2 parts of boiling water, and in 4 to 5 parts of glycerin, but insoluble in alcohol. The aqueous solution has a slightly alkaline taste, colors red litmus-paper blue, and the juice of violet flowers green.

Borax is very frequently adulterated with Glauber's salt (sodium sulphate), rock-salt (sodium chloride),

and potassium chloride. If, in a dilute and heated solution strongly acidulated with hydrochloric acid, a heavy precipitate is formed by barium chloride solution, Glauber's salt may be supposed to be present. An admixture of rock-salt is recognized by the white flakes which are formed in an aqueous solution acidulated with nitric acid, by the addition of nitrate of silver. Potassium chloride is recognized in the solution by the formation of a white crystalline precipitate on adding a large quantity of tartaric acid. The presence of carbonate of soda is shown by the effervescence of the solution on adding hydrochloric acid.

Borax is used for fixing mineral dye-stuffs, as an addition to starch, and as a substitute for alkalies (potash, soda).

*Sodium hyposulphite (hypo)* comes in the form of large white crystals readily soluble in water. It possesses somewhat the same general properties as sodium sulphite or bisulphite, but it is not employed, as are the latter, in bleaching operations. It is used by cleaners mainly as an "antichlor" or neutralizing agent on cottons bleached in chloride of lime solutions. An antichlor bath is prepared by dissolving 2 ounces of hyposulphite and one ounce of 36 per cent acetic acid to 5 gallons of cold water. The bleached fabrics are rinsed well in lukewarm water, then placed in the neutralizing bath where they are allowed to remain 10 minutes. On their removal they should be again thoroughly rinsed.

*Stannous chloride, or tin salt*, occurs in commerce in a solid form as well as in solution. In the solid

form it forms white, columnar crystals which are readily soluble in water, and have an acrid, metallic taste. It being poisonous when taken internally, care should be used in handling it. The solution of tin-salt in water always shows a more or less milky turbidity.

*Chloride of lime* is a white or whitish powder or in friable lumps, dry or but slightly damp, with a feeble odor of chlorine, and a disagreeable bitter and saline taste. Under certain circumstances it may undergo decomposition on keeping, either with the evolution of oxygen, or by conversion into a mixture of chloride and chlorate of calcium. On exposure to the air it absorbs and combines with carbonic acid and becomes moist. It has an alkaline reaction, but finally bleaches test-paper. When rubbed with water it is almost entirely dissolved, the lime remaining behind. This forms the chloride of lime solution which serves as a basis for the bleaching and decolorizing process, and for the preparation of the various bleaching fluids.

Thus the well-known *eau de Javelle* is obtained by mixing a filtered solution of 1 part of chloride of lime in 12 parts water with a solution of potassium carbonate (potash) (1 part potash in 4 parts water). The mixture is allowed to settle and is filtered.

Chloride of lime solution in the same manner decomposed by alum or aluminium sulphate gives *Wilson's bleaching fluid*; and by sulphate of magnesium, *Ramsey's or Grouvelle's bleaching fluid*. These bleaching-fluids are colorless, or of a faintly yellowish color. They are extensively used for bleaching textile

fibers, fabrics, and wash-clothes, and serve also for removing fruit and red-wine stains from the latter.

A too vigorous action of the chlorine upon the textile fiber is counteracted by subsequent immersion of the fabric in solution of sodium hyposulphite or ammonia. Chloride of lime should be used only on vegetable fibers. It is seldom if ever used in the modern cleaning plant, the several peroxides being much better and safer to use.

*Chlorine-water.* This is less frequently used than bleaching-fluid. It forms a clear, greenish-yellow liquid, possessing the suffocating odor and acrid, irritating taste of chlorine. It evaporates without leaving any residue, but separates crystals of chlorine hydrate when cooled to the freezing-point of water.

*Tartaric acid* crystallizes in colorless, oblique, rhombic prisms or tables, which are inodorous and have a strongly acid and disagreeable taste. They have the specific gravity 1.764, dissolve at 62.6° F. in 0.6 part of water, 2 parts of 85 per cent. alcohol, 3.6 parts of absolute alcohol, 23 parts of ether, and 250 parts of absolute ether; they are more soluble in the same liquids at the boiling temperature, and are likewise soluble in methyl alcohol and in glycerin, but insoluble in chloroform and benzine. It is a complete substitute for the more expensive—

*Citric acid*, with which it is frequently mixed, and in many cases even sold as such. Hence, whenever citric acid is prescribed tartaric acid may be substituted for it.

*Oxalic acid* forms flat, oblique, rhombic prisms,

which are colorless, transparent, not deliquescent, inodorous, of a strongly acid taste and reaction, and soluble in about 8 parts of water at the ordinary temperature, and in nearly all proportions of boiling water. They dissolve in  $2\frac{1}{2}$  parts of cold and 1.8 parts of boiling, strong alcohol, and are but slightly soluble in ether. Oxalic acid is very poisonous. It is rather cheap, and as in some cases it serves as a complete substitute for tartaric and citric acids, it is very frequently used. Its principal uses in spotting are confined to the removal of rust and ink stains. For this purpose a warm, five per cent. solution is applied to the portion to be treated and allowed to stand for 5 minutes, after which time it is rinsed out with warm water.

*Hydrochloric acid.* This well-known acid should be entirely free from iron, and, hence, it should not be colored red by sulphocyanide of potassium. Its uses in spotting are very limited and are confined to the removal of iron stains. A very weak solution should be used and well rinsed from the goods when the stain has been removed.

*Various spotting and washing agents.* Some stains which have not been dissolved by the benzine in dry cleaning are in most cases readily removed by carefully applying the following scouring water:

Dissolve in 5 quarts of distilled water  $2\frac{1}{2}$  ozs. of common salt and add to the solution, 8 ozs. 90 per cent. alcohol and  $1\frac{3}{4}$  ozs. ether. Shake the mixture thoroughly. It is used as follows: Moisten a clean rag or piece of soft leather with the mixture and try to remove the stain by rubbing very carefully. Silk

or goods with delicate colors has to be manipulated with special care, as by rubbing too vigorously the colors are injured and a whitish shine is produced which can only be removed by re-dyeing. This rule not only applies to the above-mentioned scouring water, but to the removal of stains in general. The lighter and the more skilled the hand of the operator is, the better for the article to be cleaned.

*Liquid spotting soap* solutions are prepared as follows: In a one-gallon bottle put  $\frac{1}{4}$  pint ordinary ether; 1 pint denatured or wood alcohol, (preferably wood alcohol);  $\frac{1}{4}$  pint glycerin; 5 pints soft water;  $1\frac{1}{2}$  pints extract of soapbark. Mix the glycerin with the alcohol, then add the mixture to the ether in the bottle and agitate, follow with the water and the soapbark extract. The soapbark extract is prepared by boiling about one part, by measure, of soapbark chips in 4 parts water; put the chips in cold water and bring to boil, and continue boiling 20 minutes; allow to cool and strain. The bottle should be kept closed when not in use.

This formula makes a spotting fluid suitable for general use on garments after dry cleaning; as it does not affect colors that are not affected by cold water, it is especially useful for spotting colored fabrics composed of silk, wool or cotton.

In place of soapbark extract, two ounces of green soft soap may be used. This makes a stronger solution, but one more liable to attack fugitive colors and it is therefore necessary to exercise greater care in using it.



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For the removal from wash-clothes of brown and black stains due to hair-dye, medicines, marking-ink, indelible pencil marks, etc., a solution of the very poisonous potassium cyanide in lukewarm distilled water is used. Great care has to be exercised in handling it. Its strength for spotting should be confined to a 10 per cent. solution.

For the removal of stains of lunar caustic or nitrate of silver, a mixture of chloride of ammonium and corrosive sublimate, each  $\frac{1}{3}$  oz. in 4 ozs. of water. A mixture of  $10\frac{1}{2}$  ozs. of Glauber's salt, 5 ozs. of chloride of lime and 10 ozs. of water can also be recommended.

*Spotting fluids.* The following compositions may be mentioned:

a. Dissolve, shaking frequently, 30 parts castile soap in a mixture of 30 parts glycerin, 7 parts strong solution of ammonia, 30 parts ether, and 300 parts water.

For use place a cloth under the place to be cleaned, then spread the fluid by means of a sponge over the stain, and treat the latter with the fluid by careful rubbing for a few seconds. Finally wash with water.

b. Tincture of soap (*spiritus saponatus*) 100 parts; 10 per cent. ammonia, 50 parts; acetic ether, 15 parts.

This mixture is suitable for oil and grease stains. Soak the stains with the fluid and remove them by means of a woolen rag.

c. Benzine, 200 parts; ether, 40 parts; acetic ether, 30 parts; turpentine, 60 parts.

d. Dissolve 10 parts of saponine in 500 parts distilled water, and mix the solution with 20 parts of ammonia of 0.960 specific gravity.

This fluid is especially suitable for the removal of grease, mildew, and dust stains.

*e.* Carbon tetrachloride, 650 parts; acetic ether, 100 parts; denatured alcohol, 100 parts; alkali oleate soluble in benzine, 8 parts; benzine, 142 parts.

This spotting fluid injures neither the fabric nor the color, acts with great ease and rapidity, evolves no odor, disappears from the fabric without leaving a trace, and is neither poisonous nor inflammable. By its use most all kinds of stains, for instance, such as are caused by gravies, fats, axle-grease, petroleum, varnish, tar, wax, oil-paint, etc., can be removed. The stains (on wool, silk, cotton, lace, carpets, felt, furs, etc.) are moistened with the spotting fluid, lightly brushed, and finally rubbed dry with a clean cotton cloth.

*f.* Strong ammonia, 31 parts; tincture of potash soap, 93 parts; soda, 7.8 parts; borax, 7.8 parts; ether, 31 parts; alcohol, 31 parts; and enough water to make the whole up to 950 parts.

Dissolve the salts in a portion of the water, then add the other constituents, and finally the ether and alcohol. This preparation is said to remove stains from all kinds of woollens, imparts gloss to black cloth, and also to be suitable for cleaning carpets.

*Spotting fluids for leather and tissues.* *a.* Ether, 1 part; turpentine, 4 parts.

*b.* Camphor, 8 parts; alcohol, 1 part; ether, 1 part.

*c.* For coarse tissues. Mix 1 part of ether with 9 parts of turpentine.

*Spotting fluid for all kinds of stains, the derivation*

*of which cannot be ascertained.* Dissolve 8 parts of castile soap in 30 parts alcohol, and add 1 part turpentine and the yolks of 4 eggs.

*Or:* Heat to the boiling-point 20 parts ox-gall, 40 parts borax, 500 parts alcohol, and 200 parts ammonia. Then add 30 parts glycerin and the yolks of 2 eggs.

*English spotting fluid* for the removal of stains of resin, acid, wax, tar and grease, consists of 100 parts by weight of 95 per cent. alcohol, 35 of ammonia of specific gravity 0.875, and 15 of benzine. Bring the weighed benzine into a glass vessel, add the alcohol, shake thoroughly, and finally add the ammonia.

*Schwemmer's spotting fluid.* This is a patented article. The solution of ammonia in alcohol and ether frequently used for the removal of stains is so mixed with turpentine that, on shaking, the fluids form an emulsion, which remains constant during the operation of spotting. A suitable mixture consists of 4 ozs. turpentine, 4 ozs. of ammonia, 2 ozs. alcohol, 2 ozs. ether, and 2 ozs. acetic ether.

*Spotting paste.* An excellent article is prepared as follows: First mix 2 parts borax with 3 parts ox-gall, then mix with it carefully 20 parts of tallow soap in the form of a fine powder, and finally 1 part oleic acid.

*Spotting pencils.* a. Soap powder 70 parts; pulverized borax, 10; carbonate of magnesia, 25; fresh ox-gall, 20; soft soap, 10. Dissolve the borax in the ox-gall assisting solution by rubbing, then mix with the solution, in very small portions at a time, the carbonate of magnesia, gradually add the soap powder and sufficient soft soap to obtain a mass of a doughy

consistency. Scatter magnesia powder upon a smooth board, roll the mass out into long sticks and cut up the latter into suitable size.

b. Mix 30 parts of quillaia extract and 30 parts of borax and make the mixture into a stiff mass with 120 parts of fresh ox-gall and about 450 parts of soap powder. Form the mass into sticks.

*Tetrapol* is an oily liquid of a yellowish color, a peculiar odor resembling that of radish, and is miscible in every proportion in water. It is a patented product, and has proved to be an excellent agent for cleaning and degreasing woolen yarn or other materials contaminated by grease. It has an alkaline reaction, and its mixture with water resembles soap-lye. *Tetrapol* may be used wherever water is employed in chemical cleaning. It is non-inflammable and is generally used cold, or at the utmost at a temperature of up to 122° F.; a higher temperature than this should be avoided.

According to an analysis by Dr. Bein, of Berlin, *Tetrapol* consists of:

	Mark	
	A.	F.
	Per cent.	Per cent.
Total content of fatty acid . . . . .	18.5	25.2
Carbon tetrachloride . . . . .	12.4	15.7
Free alkali . . . . .	not traceable	
Chlorine and kindred substances . . . . .	" "	
Total content of soap . . . . .	31.0	39.0

*Tetrapol* is used either in aqueous solution of varying concentration—a part *Tetrapol* and 2 to 8 parts distilled, or at least soft, water—or by itself as it is found in commerce. For instance, for the removal

of *oil-paint stains* cover them with a concentrated Tetrapol solution— $\frac{1}{2}$  to 1 oz. Tetrapol in 1 quart distilled water—let the solution act for one hour without rubbing, then rub the stained places with the fingers, remove the solution from the article by brushing, and finally brush with soft water. *Axle grease stains* may be removed in the same manner.

In the case of axle grease stains it sometimes happens that a brown stain will remain after the grease has been dissolved. This brown stain is caused by iron, and may be removed with a weak solution of oxalic acid.

*Oil and grease stains*, particularly those caused by mineral and lubricating oils, are removed by rubbing with Tetrapol; then follow with lukewarm water, and after a good lather has been produced, rinse with warm water until complete removal of the Tetrapol, which will carry away with it the oil, dirt, etc., composing the stain. *Blood stains* are removed in the same manner. For the same purpose Tetrapol solution—1 part Tetrapol with 4 parts water—may be used. Should the stains not disappear after this treatment, repeat the process.

In wet washing Tetrapol serves as a substitute for soap. It has the advantage of not forming a lime soap and is not decomposed by acids, as ordinary soaps are. It imparts no odor to the articles treated with it.

While the above mixtures will be of service to the man who does not thoroughly understand the work, and who, therefore, must proceed in a more or less hap-

hazard manner, it is very doubtful if it is good practice to use them. There is no mixture or compound that will remove all kinds of spots and stains from a garment, and the one who places his reliance in them is very sure to meet with difficulties from time to time. The man who has mastered the art of spotting—and it can be mastered only through experience—finds that he is able to get better results with less loss of time, and with less trouble, when he places his reliance on straight chemicals.

In spotting, immediate results cannot always be expected. Some spots and stains are very difficult to remove, and experience has demonstrated that fewer garments will be damaged and better results secured when mild solutions of the solvents are used rather than strong ones. The first rule to be observed is cleanliness. This applies to the hands of the operator, as well as to the brushes, table, cloths, tools, water and chemicals. Cleaning work cannot be done with dirty tools and in dirty surroundings. The work should be done in a well-lighted portion of the plant.

To successfully remove spots and stains from white silk and wool goods is not a difficult matter, but when spotting light and fashionably colored silks the task is not so easy, as in this case great care must be exercised to damage neither the color of the fabric nor the luster. On this class of goods it is always well to commence the spotting operation with clean, distilled water. Persuasion and a light hand must be used rather than force. Acids and ammonia must be used with extreme care. Should a spotting mark remain

after the spot has been removed, either the entire garment must be sponged or the color restored by touching the spot with a dye corresponding in color to the color of the fabric. The spotting of dark-colored silk is not a difficult matter, as the very large majority of the spots on this class of goods may be removed with clear, distilled water, and there is little if any danger of leaving water marks.

All chemicals used for spotting purposes should be kept in as clean and pure a condition as possible. A pure organic compound will evaporate from the goods much more readily than one that is contaminated with foreign matter. Thus by keeping his chemicals pure and clean the spotter is enabled to avoid making spotting rings, and his work is easier.

*Blanchissine* is a detergent manufactured by Boettiger, Lille, France.

*Blanchissine No. 1* is composed as follows: Caustic soda, 8 parts; alcohol, 29; olein, 24; glycerin or vaseline, 2; turpentine, 4; ultramarine, 2. Of this composition 2 ozs. are to be used with 22 gallons of water. It may be employed for washing the finest silk fabrics, as well as ordinary clothes.

*Blanchissine No. 2* is composed of: Ammonia, 64 parts; olein, 5; turpentine, 25; benzine, 6. For washing fine articles—laces, etc.—in the washing machine, add  $3\frac{1}{2}$  ozs. of this composition to 22 gallons of water.

*Hexol*. This is a volatile yellow liquid with a peculiar but not disagreeable odor, and forms a concentrated detergent, which may be used as such, or diluted with about 2 volumes of benzine or 95 to 96 per cent.

alcohol, or a mixture of both. Shaken up with 5 parts of water, it gives a milky liquid, suitable for removing stains on white articles and the like.

In chemical cleaning it may replace fusel oil, chloroform, acetic ether, etc., and its application is followed by treatment with benzine, to eliminate all final traces of stain. It readily takes out stains arising from pitch, oil, tar, etc., and in the concentrated form is useful in removing old or obstinate stains caused by paint or tar.

*Cleaning dust-coats.* When cleaning garments of this kind it is best to go over them entirely, as in partially treating them rings are readily formed. Hems and seams, as well as lined cuffs and collars, should be treated last, slightly moist. As scouring water use a mixture of water, 6 parts; ether, 6 parts, and acetic acid, 1 part.

In case stains of oil, paint or other difficult stains are found, the wet article is best treated with benzine, then using immediately the above-mentioned scouring water, and finally drying thoroughly with a piece of buckskin.

*Morning dresses, rain-coats, etc.,* which, as a rule, are only soiled around the bottoms, are treated by moistening the stained portions with water acidulated with acetic acid, or if the color will stand it, with soap water. Then rinse, scour, rinse and extract.

*Stains in velvet and plush* are removed with ether and water, brushing against the grain, and when dry with the grain. For dark and black velvet, alcohol is very suitable.



In removing stains from lined garments it is advisable to open, if possible, a seam, and push a small board covered with linen between lining and goods to prevent the former from becoming wet.

In case some stains cannot be completely removed from white garments, try to hide them as much as possible by covering them with a white substance, such as starch, gypsum, magnesia, or talcum, or it may be bleached out with peroxide or chloride of lime.

The following spotting fluid may be advantageously used for silk: Distilled water, 1 quart; ether, 1 quart; acetic acid,  $\frac{1}{8}$  quart. For one-color, acid-dyed woolen stuffs use only distilled water acidulated with acetic acid; for one-color woolen stuffs dyed with wood-dyes, distilled water with an addition of ammonia and ether; for one-color and colored half-wool and cotton goods, distilled water with an addition of ether; for colored woolen and half-wool stuffs, distilled water only; for black and white half-wool stuffs, as well as for striped and checkered, a scouring water consisting of distilled water, 1 quart; ether, 1 pint, and  $4\frac{1}{5}$  ozs. common salt.

In removing stains the operations must not be carried on too wet, and nothing but the stain to be removed should be treated. The spot should be dried as quickly as possible to prevent the formation of rings, which is frequently the case in working with watery substances. Light-colored silk goods are most difficult to manipulate, as rings are likely to form and the places to be treated readily lose luster. In this case attempts should be made to dissolve the stain or

remove it by working from the wrong side of the goods. This refers to the treatment with water; benzine and ethereal substances may be more energetically applied.

Suitable agents for absorbing water, or water solutions, to prevent rings or water-marks after spotting, are a soft bleached sponge, bleached cheese-cloth, or chamois skin. After the spotting operation is completed, the treated section is rubbed over lightly with a soft sponge or cloth to absorb the surplus moisture and at the same time so spread the solvent that no definite edge remains which would show on drying. The prevention of rings and water-marks is largely a matter of skill in this operation. Some spotters go over the treated section again with a cloth dampened with denatured alcohol or acetone.

The rings formed in removing stains in raw silk garments, as well as water and rain stains, are got rid of by steaming or by sponging the entire garment.

The water ring may also be prevented and a great deal of trouble saved by having a moderately heated puff iron near the spotting-table. As soon as the spot has been removed with water, and the superfluous water has been sopped up with a sponge or white blotting-paper, place the wet part over the heated puff iron and iron the edges of the water mark.

Another effective method which will prevent water marks or rings is the spraying bottle. The bottle is filled with an inch of distilled water, and a sectional glass blowpipe attached to the neck. As soon as the spot has been eradicated, take the bottle and blow into the glass tube, in this way sending a fine spray

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of water over the water ring, then take a clean white rag and rub the spray over the spot until the ring has disappeared, or, in other words, even up the edges of the ring.

This method is very effective on pongees, though most of the spotters either use the puff iron or a regular iron and iron the wet edges at once. A pongee garment should never be allowed to dry, as this would necessitate the sponging of the whole garment, and frequently create new spots on account of the irregularity of the weft. There are quite a number of so-called pongees. These are mostly imitations, and it is nearly impossible to remove any spot from them without removing the color at the same time. Water seems to be the greatest enemy of these garments, and it is advisable always to have handy a bottle of acetic acid, and as soon as it is noticed that the color is disappearing, daub a little diluted acid on the spot. The acetic acid should be diluted with one-third of water.

Color or dye spots, principally such as have run off from other garments, ribbons, or umbrella drippings cannot be removed from imitation pongees without destroying the original color, and it is not advisable to touch the spots except when the customer is willing to accept the responsibility.

*Dust stains* are best removed by thorough beating and brushing, or by running the garment in a tumbler or dust-wheel. Old, dried-in stains in fabrics of wool, silk, satin, etc., are brushed over with a little yolk of egg mixed with alcohol, which is allowed to dry and

then scraped off. Any adhering yolk of egg is finally removed by means of a clean rag and warm water.

*Mud stains* should be allowed to get perfectly dry before trying to remove them, and usually a good brushing will be all that is required. If, however, the stain remains, it can be easily and quickly removed by sponging the soiled portions with a weak acetic acid water.

*Stains of unknown derivation* in plain or dyed cotton goods are first treated with a very weak, lukewarm solution of soap, to each quart of which a teaspoonful of ammonia has been added. Washing is effected with a sponge or tampon dipped into the fluid. The fabric is finally washed in water.

It may here be again remarked that before attempting the removal of stains, an experiment should in all cases be made on a portion of the fabric where, if a change in the color should take place, it would be least noticed.

For cleaning *woolen goods*, especially when colored, sponge the entire garment with a neutral soap solution. Work rapidly and finish by rinsing in a weak acetic acid water.

*Grease stains*, recent as well as old, are generally removed by dry cleaning. If oil stains are not removed in the dry cleaning and if a spotting with chloroform or carbon tetrachloride fails to dissolve them, a good plan of dealing with them is to rub them over with a little oleic acid, allow this to soak in, then treat the stains with soap and water, which will, as a rule, be found effective in removing them. However, as the

fabric may be affected by the soap, the following plan may be recommended: Wet the fabric, with the exception of silk, and after placing several thicknesses of blotting-paper under the stained portions, rub with a tampion and a sponge dipped in benzine or turpentine. When the stain has disappeared from the surface, place a piece of blotting-paper upon it and pass a hot flat-iron several times over it. The entire fabric is finally sponged in warm soap-water, to which ammonia has been added, or, still better, in a warm decoction of soaproot or of quillaia-bark.

The use of benzine for the removal of grease spots has the disadvantage that a spotty appearance is frequently left on the fabric. To overcome this defect, the use of the following preparations has been recommended:

*Benzinized magnesia.* This is prepared by mixing *calcined* magnesia (not carbonate of magnesia) with just sufficient pure benzine so as to moisten it without being pasty. It should be just wet enough so that when the mass is pressed between the fingers, a small quantity of liquid benzine is squeezed out. In this state it forms a crummy mass which is kept for use in a well-corked, somewhat wide-mouthed, glass bottle. For use spread the preparation quite thickly over the stains and rub it thoroughly to and fro with the tip of the finger. Brush off the small lumps of earthy matter thus formed, lay on more of the preparation, allowing it to remain until the benzine has entirely evaporated, and then brush off the adhering particles of magnesia.

*Gelatinized benzine* may be used in the same manner, it being in many cases preferable to benzinized magnesia. It is prepared by dissolving in a quart bottle 120 parts of soap in 180 parts of hot water and adding 30 parts of ammonia. Then add sufficient water to fill the bottle three-quarters full, next sufficient benzine to fill it entirely, and shake.

Of this solution, mix one teaspoonful in a half-pint bottle with some benzine, and, after mixing, fill the bottle with benzine, shaking constantly. With this gelatine, stains of all sorts can be removed without risk of injury to even the most delicate colors. However, if, on account of the employment of benzine, the formation of circles, rings, etc., is feared, scatter upon the place, while still wet, plaster of Paris or talcum, which after drying is brushed off.

In many cases, especially when the grease-stains are fresh, the damage may be remedied by the use of ammonia or weak soda solution, and subsequent washing. From silk fabrics grease stains are removed with benzinized magnesia or gelatinized benzine; etherized magnesia, which is prepared in a similar manner as benzinized magnesia, being, however, preferable for the purpose.

*Etherized magnesia* is prepared by mixing calcined magnesia with sufficient ether to form a thin paste, which is spread over the stains. When the ether has vaporized, brush off the magnesia spot and finally rub with a piece of soft white bread. Under certain conditions, etherized magnesia, as well as alcohol, may, however, act energetically upon colors.

All stains of a fatty nature disappear by thorough chemical cleaning, and there remain behind only the so-called water-stains, and those due to milk, soup, beer, etc., which can be brushed out with water. Such stains, as well as those of coffee, wine, sugar and tea, disappear from white goods by treatment with lukewarm soap solution and thorough washing with water. Checked and all other stuffs, for which soap cannot be used, are treated with cold water slightly acidulated with acetic acid, which generally accomplishes the object, and does not injure even the most delicate colors. When the entire front of a coat is covered with smaller and larger stains of this nature, it is best to work from seam to seam, spreading the coat upon the scouring-board, brushing it thoroughly and quickly with water, and absorbing the latter at once with a piece of buckskin. Special attention must be paid to the lining because by pressure it frequently produces darker stains. Care must also be had that the coat does not lose shape by this treatment, and that the stiffening and interlining are not shifted; hence as little water as possible should be used.

Very old grease stains are first treated with chloroform or carbon tetrachloride, and then with benzinized magnesia. Stains of solid fats, such as tallow, lard, wax, paraffine, ceresine, etc., are first softened with castor oil and then treated as above. Saponification of the grease in the tissues by the use of ammonia or soda lye cannot be recommended for wool and silk, and for cotton and linen only when the colors are fast to soap; with these materials satisfactory results are,

as a rule, also obtained with ether, benzine or chloroform.

Grease stains upon the backs of garments caused by long hair, are removed by rubbing with a piece of cotton dipped in the following mixture: Ammonia, 4 spoonfuls; common salt, 1 spoonful; shake thoroughly. Or, dissolve a small quantity of gall soap in water, moisten a small brush with the solution, brush the stains and rinse in clean water.

*Paint and varnish stains* are first treated with pure turpentine. Old stains are best removed by repeated applications of a mixture of turpentine and chloroform, the solvent being allowed to soak in well before the application of blotting-paper as described under "grease stains." There is one objection to the use of turpentine; it is a difficult matter to eradicate its odor from the garment on which it has been used. Chloroform by itself is also an excellent solvent for old paint and varnish stains, as are also aniline oil, acetone, and benzole.

*Stains of resin, tar, or wagon-grease.* To remove these and similar stains from white goods, moisten the fabric, rub the stain with a sponge dipped in turpentine, place blotting-paper beneath and on top of the grease spot, and pass a hot iron several times over it. Finally wash the entire fabric in warm soap water. Colored cotton or woollen fabrics are moistened, the stains thoroughly soaped, and after allowing the soap to act for a few minutes, washed alternately with turpentine and water.

If the stains do not yield to this treatment, spread



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a mixture of yolk of egg and turpentine over the stains; when dry scrape it off, and finally wash in hot water.

As a final means, the fabric may be washed in water to which some hydrochloric acid has been added, and thoroughly rinsed in soft water.

Articles of silk, satin, etc., are moistened, and the stains rubbed with a sponge dipped in a mixture of ether and chloroform. When the stain has disappeared scatter bole (pipe-clay) upon the place, cover with blotting-paper, and pass a hot iron several times over it.

If the stain has not disappeared, mix yolk of egg with chloroform, spread the mixture over the stain, allow it to dry, then scrape off, and treat as previously described. Aniline oil is an excellent solvent for resin stains, and it also readily dissolves tar. Ether will sometimes move tar stains when all other reagents fail to do so.

*Stearin and wax-stains* are carefully removed as much as possible with a knife. Then place a wet linen rag beneath, and blotting-paper on top of the stain, and pass a warm flat-iron over it.

If the stain is inaccessible with the flat-iron, treat it with chloroform, which will surely remove it.

*Fruit stains* disappear from linen goods (table-cloths, napkins, handkerchiefs, etc.), by rinsing in *eau de Javelle* or another bleaching-fluid, or in weak solution of chloride of lime, which must, however, be perfectly clear, and to which some vinegar may be added. When the fabric is clean, it is thoroughly rinsed in running

water and best drawn through a solution of sodium hyposulphite, or of soda.

White cotton goods may be treated in a similar manner. Fruit stains frequently disappear by simply washing in soap water to which some borax or ammonia has been added.

*Fruit stains* on woolen and silk goods should be treated with weak glacial acetic acid. Daub the spot with the acid and follow with a bleach of sulphurous acid or hydrogen peroxide if the colors are found to be fast to these bleaches when used weak. If the colors will not stand the bleaching treatment follow the glacial acetic acid with methyl alcohol.

*Stains of red wine, cherries, whortleberries, etc.*, in white goods are treated in the same manner as fruit stains.

In many cases wine stains may be removed by sponging with soap and water. If this fails to remove them they must be treated in the same manner as fruit stains.

*Milk and coffee stains.* Apply a mixture of yolk of egg and glycerin, then wash in warm water, and while still moist, iron the fabrics upon the wrong side with a flat-iron, which should not be too hot.

As a rule, milk and coffee stains are difficult to remove, especially from light-colored and finely finished goods. From woolen and mixed fabrics they are taken out by moistening them with a mixture of 1 part glycerin, 9 parts water, and  $\frac{1}{2}$  part ammonia. This mixture is applied to the goods by means of a brush and allowed to remain 12 hours, occasionally renewing

the moistening. After this the stained pieces are pressed between cloth and then rubbed with a clean rag. Drying, and if possible, a little steaming, are generally sufficient to thoroughly remove the stains.

Stains on silk garments which are dyed with delicate colors, or finely finished, are more difficult to remove. In this case, 5 parts of glycerin are mixed with 5 parts of water, and  $\frac{1}{4}$  part of ammonia added. Before using this mixture it should be tried on some part of the garments where it will not be noticed, in order to see if the mixture will change the color. If such is the case, no ammonia should be added. If, on the contrary, no change takes place, or if, after drying, the original color is restored, the above mixture is applied with a soft brush, allowing it to remain on the stains for 6 to 8 hours, and is then rubbed with a clean cloth. The remaining dry substance is then carefully taken off by means of a knife. The damaged places are now brushed over with clean water, pressed between cloths, and dried. If the stain is not then removed, rubbing with dry bread will cause it to disappear. To restore the finish, a thin solution of gum arabic—in many cases beer is preferred—is brushed on, then dried, and carefully ironed. By careful manipulation the above-mentioned stains will be successfully removed.

*Soup stains, as well as smaller grease-stains in general,* are removed by sponging with hot water to which some soda, or borax, or ammonia has been added.

Stains on cotton goods need only be rubbed with rectified oil of turpentine or benzine. The surplus

of the solvent is then removed with blotting-paper and the fabric washed in clean soap-water, whereby the stains will be successfully removed.

Silk fabrics are treated in the same manner, ether, chloroform, or carbon tetrachloride being, however, preferred to benzine.

*Stains of beer, wine, punch, sugar, gelatine, glue, etc.* Comparatively speaking, these stains are very readily removed, simple sponging with clean, tepid soap-water being in most cases sufficient. If necessary, the fabric may be bleached in *eau de Javelle* or another bleaching fluid, or in perfectly clear solution of chloride of lime to which some vinegar has been added. It is finally thoroughly rinsed in water, or, still better, in a solution of hyposulphite of soda, to remove any excess of chlorine that might be present.

*Grass stains* may be removed from all classes of goods by spotting with ether.

*Stains from green nuts, as well as so-called tannin stains,* are repeatedly sponged with water and alcohol, then treated with dilute chlorine-water, pure, perfectly clear chloride of lime solution acidulated with vinegar, or one of the various bleaching-fluids, and finally washed in much water. Stains caused by walnut shells or the juice therefrom cannot be removed satisfactorily by means of chlorine or sodium perborate bleaches, neither can they be removed by stripping salts. These stains are similar in character to stains caused by photographic developers and must be similarly treated.

*Acid stains,* when fresh, disappear by moistening

them with ammonia or soda solution, the original color being in almost all cases restored by the subsequent application of chloroform.

Old stains resist all reagents and have to be re-dyed.

*Nitric acid stains.* These stains are generally of a yellow color, and, when fresh, can be removed from brown or black woolen garments by moistening them for a while with concentrated solution of permanganate of potash and rinsing with water. Old stains are brushed over with nitrate of silver solution, whereby they acquire a black color. Concentrated nitric acid will almost immediately destroy any fabric with which it comes in contact.

*Stains of wine-vinegar, sour wine, etc.,* are removed by neutralizing the acid with water of ammonia, soda, or a similar agent.

*Lye and lime stains* disappear from linen fabrics by washing. From cotton, woolen, and silk goods the stains are removed by carefully applying to them, drop by drop, any dilute acid (with the exception of sulphuric and tartaric acids), until they have disappeared, and then thoroughly washing. A weak solution of hydrochloric acid free from iron is best suited for the purpose. When the stains disappear the acid must be rinsed from the goods.

*Urine stains* are treated with alcohol or dilute citric acid solution, and the place where the stain has been is revived with chloroform. The following mixture will also be found useful: Tartaric acid, 1 part; water, 30 parts. Or, oxalic acid, 1 part; water, 10 parts.

*Perspiration stains* are removed from woolen and

cotton goods with sodium hyposulphite, or a perborate of sodium solution, and subsequent washing with water; from silk and satin, also with dilute sodium hyposulphite solution, or, from silk with strong salt water in which the article is allowed to remain 3 to 4 hours. From worsted and cheviot garments perspiration stains are removed by brushing with benzine, and finally by washing with soap and water. If, as is frequently the case, the ground color of colored goods is injured by this process, it has to be remedied by re-dyeing.

Perspiration stains are removed from woolen goods with distilled water and a small quantity of castile soap solution by brushing the spot and then rinsing to remove all the soap; the spot is finally moistened with saccharic acid solution. Subsequent thorough washing is absolutely necessary, as otherwise the lining would be burned by the remaining acid. Silk articles as well as cotton goods are treated in the same manner, chlorine instead of saccharic acid being, however, used for the latter. By reason of the varying constitution of the stuffs no general rule can, however, be laid down and the removal of such stains has to be done by a skilled hand.

Perspiration stains may also be removed with a mixture of 1 part ammonia, 3 parts alcohol, and 3 parts ether. From white linen and cotton goods they are removed by rational washing with soap.

Uniform facings, cuffs, pocket-flaps, etc., of a red or other color, when soiled by perspiration, are first chemically cleaned with benzine soap. They are

next thoroughly brushed and rinsed in clean benzine. When the benzine has evaporated, they are again thoroughly brushed with lukewarm water to which ammonia has been added, then rinsed by means of a sponge with lukewarm water and dried with a flannel rag of the same color as the goods. By the application of the water and ammonia, the dirt immediately dissolves so that it can be removed with the finger nail or a dull knife. Perspiration very frequently weakens delicate fabrics and the utmost caution must be used in such cases not to tear or injure the garment.

*Greasy shine* of men's worn worsted or cheviot garments is removed by gently rubbing the shiny places with glass or emery paper, and then vigorously vaporizing by means of a moist cloth and hot iron, or by steaming. If the color of the goods allows, the places may also be thoroughly brushed with alum solution, dried and ironed while quite damp.

*Nitrate of silver stains* in white goods are removed with a fluid consisting of 100 parts by weight of distilled water, 4 parts by weight of ammonia, and 4 parts by weight of chloride of mercury. These stains may also be treated successfully by first washing them with water and then daubing them with a tincture of iodine and, lastly, with potassium cyanide. Care should be taken not to damage the dye.

*Aniline color stains.* Red stains due to aniline color are removed with hot alcohol or with soda solution heated to 122° F., provided the ground color is sufficiently fast not to be attacked by the soda or the alcohol.

*Ink stains.* These may be due to aniline ink and nutgall ink.

In the first case the stains—provided they are not on silk fabrics—will generally yield to washing in soap-water, in a bleaching fluid, or in alcohol acidulated with vinegar.

The removal of stains due to nutgall ink is more difficult. If not too old, stains on linen fabrics sometimes yield by laying the latter in a bleaching fluid or chloride of lime solution, allowing them to remain for some time. In applying these substances great care must be taken, especially with bleaching fluid, not to use them too strong, or they will act upon the fabric and destroy it.

The stains also frequently disappear by treating them with a concentrated solution of oxalic, tartaric, or hydrochloric acid.

A peculiar method of treating ink stains, as well as iron-mold stains, is as follows: Scatter upon the moistened stain pulverized oxalic acid and rub it into the tissue with a bright piece of iron; or stretch the stained portion of the fabric over a heated bright tin pot or tin plate, and rub in the powdered oxalic acid. The action is the more effective the more intimately the stain is brought in contact with the heated metal.

To produce the best effect it is only necessary to scatter fine tin dust or tin shavings upon the stain previously moistened with hot oxalic acid solution. The stain disappears as if by magic.

*Another method* is as follows: Mix equal parts of cream of tartar and citric acid, powdered fine. This



forms the salt of lemons as sold by druggists. Procure a hot dinner-plate, lay the part stained on the plate, and moisten with hot water; next rub in the above-mentioned powder with the bowl of a spoon until the stain disappears; then rinse in clean water and dry.

The stain may also be washed in a solution of yellow prussiate of potash to which sulphuric acid has been added, and the blue spot thereby formed removed by rinsing in potash solution. If, after this, a yellow stain should remain, it is removed with sulphuric acid.

Beschorner recommends the following process: Place the linen fabric in a mixture of 15 parts distilled water and 2 parts hydrochloric acid, allow it to remain in the mixture for half an hour, then wash thoroughly in clean water, and pour ammonium sulphide over the still moist stain; the latter operation should be conducted in the open air. After ten minutes, when the iron has been converted into ferrous sulphide, rinse the linen in clear water, pour a mixture of 1 part hydrochloric acid and 15 parts distilled water over it, and again rinse in clean water.

For stains on fabrics dyed with fast colors hydrogen peroxide, perborate of sodium, or tartaric acid may be used.

Old ink stains are sponged in dilute chloride of tin solution, and the fabric thoroughly rinsed in soft water.

From silk fabrics ink stains, in many cases, cannot be removed, the only remedy being to re-dye the stained portions.

From scarlet woolen fabrics black ink stains can be

readily removed by moistening the stain with cold water by means of a white rag, then applying a few drops of lemon juice, and after the disappearance of the black stain sponging with clean cold water.

In place of the method of removing ink stains by means of oxalic acid and subsequent treatment with potassium permanganate, the following process is recommended: Prepare so-called aceto-oxalic acid by saturating 10 per cent. acetic acid with oxalic acid, and mix 1 part of the product with 4 parts of alcohol. The solution, which depends for its action on the solubility of iron oxalate in alcohol, will eradicate stains caused by ferro-gallic inks, and it may also be used for stains arising from copying and aniline inks. To colored stripe goods it must, however, be applied with care, as there is some risk of the colors running, so that an aqueous solution of the mixed acids is preferable for such fabrics. One of the chief advantages of the alcoholic solution is that it will dissolve ink stains on light-colored fabrics without affecting the dye; and it is also applicable for removing colored stains, such as produced by chlorophyll (*grass stains*).

*Blood stains.* A solvent or a bleaching action is necessary to remove blood stains. Spot with a 50-per-cent. solution of lactic acid followed by peroxide of hydrogen or glacial acetic acid. The action of these two reagents should first be tried on a clipping of the material to determine their effects on the color. Fabrics containing many and old blood stains may advantageously be soaked in cold water for a few hours.

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*Metallic oxide stains.* These stains, as a rule, have a brown-bluish appearance and are not difficult to remove, providing the use of oxidizing agents, which tend to fasten the stain, are avoided. A spotting with dilute nitric, hydrochloric or oxalic acid will remove them. After the stain has disappeared all acid must be rinsed from the goods. When the stain is on colored goods the color must be tested to see that the dye is fast to the particular acid used.

*Stains of artificial perfumes.* Artificial perfumes are now in common use and many stains caused by them prove very obstinate. Many of them are easily removed with a mixture of acetic acid and alcohol, if the mixture is used warm, and if the garment to be cleaned is white, at least where the stain appears. Many dyes bleed when the mixture of acid and alcohol is applied. The problem is again complicated by the fact that many perfumes are prepared with impure alcohol containing fusel oil and resins. Fusel oil and resins leave, after evaporation of the alcohol, green, yellow and brown stains. Some perfumes also leave dull-white patches of stearine. All these stains require treatment with ether, great care being taken to prevent the stains from spreading. To do this the ether must be applied around the stain before using it on the stain itself. A subsequent treatment with rectified alcohol or aniline will take out any traces of perfume stain which the ether may have failed to remove. If, however, the perfume stain is associated with discoloration due to other agencies, the part of the stain for which the perfume is responsible must be

first removed as above directed. The remaining stain will almost always yield to the joint action of oxalic acid and hydrogen peroxide, or sodium perborate.

In the case of silk it is a good plan to dampen the place where the stain has been with strong alcohol, which is then allowed to evaporate. This treatment will restore the luster which is nearly always affected by the stain removal. The effect of the alcohol on the dye should first be tested.

*Iron and rust stains* may generally be removed in the same manner as metal stains. They frequently disappear readily and rapidly by placing the fabrics in a bleaching fluid or a clear solution of chloride of lime acidulated with acetic acid, and finally thorough washing in water.

The stains also disappear in boiling solution of tartaric acid. Very good results are frequently obtained by the use of warm solutions of oxalic, tartaric or citric acid.

The removal of iron or rust stains, which at the same time form oil or fat stains, is, however, more difficult. It may most readily be accomplished by washing in a bath of 1 part soft soap, 1 part glycerin, and 3 parts water.

*Mold and mildew stains* are formed in fabrics of any kind kept in a room from which the air is excluded. The dressing on the damp places dissolves and on slowly drying penetrates into the fabric. For the removal of such stains alcohol is first used, which dissolves the dressing. Then dab the stains with ammonia, allowing it to act for a few minutes; next,

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without previous rinsing, dab them with potassium permanganate, allowing it also to act for a few minutes; then moisten with hydrogen peroxide, and finally wash thoroughly. A 10 per cent. solution of oxalic acid will also remove mold stains.

*Old mold stains* are removed as follows: Saturate a white rag with ammonia, wrap it in another clean dry rag, place it on a steamer, draw the stained article over the rag and for several minutes pass steam through it. The stains are then treated with potassium permanganate and hydrogen peroxide as described above.

Colored articles with mold stains may be treated in the same manner, but with the omission of the bleaching agents. After steaming over the rag saturated with ammonia, the stained portions are moistened with acetic acid and again steamed to restore the original color. Instead of alcohol for the first treatment, acetic ether may be used to advantage.

When stains are to be removed from dyed fabrics, a preliminary test should be made to ascertain the behavior of the dye towards the reagent, this being especially necessary with fabrics upon which the coloring matter is not fixed, and which yield the latter by simple treatment with water or soap-water.

*Alkali.* Stains of alkali often remain after mud and dust have been removed from garments. They require a neutralizing action to remove them and should be treated with a weak acid solution and rinsed. Acetic acid is well suited for this purpose.

*Berry stains* should be treated in the same manner as fruit or dye stains. Either a solvent or a bleaching

action is necessary. If the stains are on dyed goods, spot first with a weak acid solution, rinse, and finally sponge the spot with a soap solution. If they are on white goods and prove to be obstinate they may be bleached out.

*Candy stains* may be removed by sponging with soap and water. If chocolate is present it is sometimes necessary to follow the sponging operation by a spotting with glycerine.

*Chocolate stains* may be removed in the same manner as coffee stains. Glycerine is often of assistance in removing old and obstinate ones.

*Developer stains* are found on the garments of professional and amateur photographers. To remove them proceed as follows: Dissolve a small amount of sulphide of soda in water and add a few drops of hydrochloric acid. Daub the spot with this solution and when it has disappeared rinse thoroughly that portion of the garment that has been treated. The dye and the fabric should first be tested to make sure this treatment will damage neither.

*Dye stains* are generally caused by the color from one garment running or bleeding into another under the influence of perspiration or rain. It is a difficult matter to remove these stains without injuring or removing the original color of the fabric. The action of ammonia and soap will sometimes accomplish the desired results, if not, a bleaching action must be resorted to. The hydrosulphite compounds are generally resorted to in this emergency. If a garment is badly stained the cleaner will do well to leave it alone or to

get the customer's permission to go ahead with the work rather than to assume the responsibility.

*Egg spots* may be removed by spotting with chloroform, also by sponging with soap and water.

*Fly specks.* Moisten the spot and remove the adhering matter by gently scraping with the finger nail or the back of a knife blade.

*Chewing gum.* Place a piece of ice over the gum and allow it to remain until the gum becomes hard and brittle. The gum may then be removed by a gentle scraping and by working the goods between the fingers. If any remains after this treatment it may be dissolved with chloroform.

*Copper stains.* Spot with a weak solution of oxalic acid or hydrochloric acid. Rinse the acid from the goods after the spot has been removed.

*Iodine.* Spot the stain with warm water to which potassium of cyanide has been dissolved. This chemical is very poisonous and great care must be used when handling it. A 10-per-cent. solution of soda to which some ammonia has been added is also useful as a spotting agent for removing these stains, as is also a ten per cent. solution of hypochlorite of soda.

*Medicine.* As a rule the ingredients in the particular medicine causing the stain are not known, and the cleaner must work in the dark to a great extent. Quite often a sponging with soap and water will remove medicine stains, but generally they are quite obstinate and require a more vigorous treatment. If the stain is the result of a metallic salt a spotting with a weak oxalic or hydrochloric acid will turn the trick. When

the more common methods fail the stain should be treated in the same manner as an iodine stain.

*Mustard stains* require a solvent treatment. A sponging with soap and water will generally remove them.

*Scorch.* If the scorch is on white goods and the fabric is not damaged it may be removed by bleaching with a bleach suited to the particular fabric. If the fabric is damaged or if the burned area is of large extent it is generally impossible to better matters. If the scorch is on colored goods it may often be corrected by covering the damaged area with a complementary color, a pale bluish violet.

*Shoe polish* is generally composed of a color in a soluble oil. The first step, therefore, is to dissolve the oil. This may be done by spotting with benzine, chloroform, tetrachloride of carbon, etc. If a stain remains it may be bleached out with hypochlorite, if on cotton goods, and with permanganate if on woolen goods. Give the solvent a fair chance to do the work before resorting to the bleach.

*Tea stains* require a solvent action. Sponge the stained areas with soap and water followed by a treatment with dilute acetic acid if necessary.

*Walnut stains* must be treated in the same manner as developer stains.

*Wood-finish* stains on garments can be removed by the same methods recommended for removing color stains.

The following table gives at a glance the best means of cleaning all kinds of fabrics from those stains most frequently met with in everyday practice.



KIND OF STAIN.	FROM LINEN.	FROM COLORED GOODS.		FROM SILKS.
		COTTON.	WOOLEN.	
Sugar, glue, blood, and albumen.		Simple Sponging with water.		Sponging with water.
Grease.	Same as silk.	Same as silk.	Same as silk.	Benzine, ether, ammonia, potash, magnesia, chalk, yolk of egg, carbon tetrachloride.
Varnish and oil-paints.		Turpentine, or benzine, and soap, aniline oil.		Benzine, ether, soap; rub carefully; aniline oil.
Stearine.		Very strong alcohol, 95 per cent.		
Vegetable colors, red wine, fruit, red ink.	Sulphur vapors; warm chlorine water, bleach.	Sponge with warm soapsuds or ammonia water; methyl alcohol.		The same; rub gently and carefully.
Alizarine ink.	Tartaric acid; the older the stain, the stronger the solution.	Dilute tartaric acid if the stuff will bear it.		The same; with care.
Iron-rust, and ink made of nut-galls.	Warm oxalic acid solution; dilute hydrochloric acid; then tin shavings.	Repeated sponging with a solution of citric acid, if the colors will bear it.		Spot with diluted mineral acids.
Lime, lye, or alkalies.	Dilute acids.	Drop dilute acetic acid upon it. The stain previously moistened can be rubbed off with the finger.		
Tannin, green nut shells.	Eau de Javelle, warm chlorine water; concentrated solution of tartaric acid.	Alternate sponging with water and with more or less dilute chlorine water, according to the colors.		
Coal tar, wagon grease.	Benzine, carbon tetrachloride, chloroform.	Benzine, carbon tetrachloride, chloroform.		Benzine, carbon tetrachloride, chloroform.
Acids.	Red acid stains are destroyed by ammonia, followed by thorough sponging with water. Brown stains of nitric acid are permanent.			

The preceding table and the receipts previously given, together with the directions which follow, afford a ready means of determining the proper method of procedure. Taking out grease and other spots and stains from clothes is an application of chemistry which is of practical interest to everybody. It demands a certain acquaintance with solvents and reagents, even though the laws of chemical affinity on which their action depends may not be understood. The general principle is the application to the spot of a substance which has a stronger affinity for the matter composing it than this has for cloth, and which will render it soluble in some liquid so that it can be washed out. At the same time it must be something that will not injure the texture of the fabric or change its color.

The following directions apply especially to the garment dyer:

Steam has the property of softening fatty matters and thus facilitating their removal by reagents.

Sulphuric acid may be employed in certain cases, especially to brighten and raise greens, reds, and yellows, but it must be diluted with at least 100 times its weight of water or more, according to the delicacy of the shades.

Hydrochloric and oxalic acids in dilute solutions are used with success for removing spots of ink, iron-mold, and metal stains upon a great number of colors which it does not sensibly affect.

Sulphurous acid is only used for bleaching undyed goods, straw hats, etc., and for removing fruit stains.

upon white woolen and silk fabrics. The fumes of burning sulphur are also employed for this purpose, but the liquid acid (or a solution of the bisulphite—not *bisulphate*—of soda or magnesia) is safer.

Dilute oxalic acid serves for removing spots of ink and iron, and the residues of mud spots which do not yield to other cleansing agents. It may be employed for destroying the stains of fruit and astringent juices, and stains of urine which have long been upon any tissue. Nevertheless it is best confined to undyed goods, as it attacks not only fugitive colors, but also certain of the lighter fast colors. The best method of applying it is to dissolve it in cold or lukewarm water, and to let a little of the solution remain upon the spot before rubbing it with the hands.

Citric and acetic acids serve to revive and raise certain colors, especially greens and yellows; they destroy the effect of alkalies or any bluish or crimson spots which appear upon scarlets.

Ammonia is the most energetic and useful agent employed for cleaning tissues and silk hats, and for quickly neutralizing the effects of acids. In the latter case it is often sufficient to expose the goods to the fumes of this alkali in order to remove such spots entirely. Ammonia gives a violet cast to all shades produced with cochineal, lac, the redwoods, or logwood, and all colors topped with cochineal. It does not deteriorate silks, but at elevated temperatures it perceptibly attacks woollens. It serves to restore the black upon silks damaged by dampness.

Carbonate of soda (soda crystals) serves equally

in most of the cases where ammonia is employed. It is good for hats affected by sweat. Soda and potash only serve for the white goods of linen, hemp, or cotton, because these alkalies attack colors and injure the tenacity and suppleness of woollens and silks. For the same reason white soap only is to be recommended for cleaning white woolen tissues.

Mottled soaps serve for cleaning heavy stuffs of woolen or cotton, such as quilts. For such articles as do not require great suppleness or softness of feel, the action of the soap may be enhanced by the addition of a small quantity of potash.

Soft potash soaps may be usefully employed in solution together with gum-arabic or other mucilaginous matters, for cleaning dyed goods and especially self-colored silks. This composition is preferable to white or marbled soaps, as it removes the spots better, and attacks the colors much less.

#### BLEACHING PROCESSES APPLICABLE TO SPOTTING.

When in spotting nothing can be done by means of solvents such as benzine, alcohol, carbon tetrachloride, ether, etc., recourse is had to bleaching, though many cleaners do not care to do so, fearing loss of color. However, every cleaner should understand the dyes he has to deal with. All basic dye-stuffs such as rhodamine can without hesitation be bleached with potassium permanganate and sulphurous acid. To be sure, pale places will sometimes be found. In green articles the places remain yellow,

but by dabbing the bleached stains with acetic acid and drawing over the steamer, the original color is restored.

The following bleaches may often be used to good advantage for spotting purposes. Whenever their use is contemplated the spotter must first test them on the fabric, if it is colored, to make sure that it will not damage the dye:

*For white cotton goods:* permanganate of potash, bisulphite of soda, calcium hypochlorite perborate of soda, hypochlorite of soda and hydrogen peroxide.

*For colored wool and silk goods:* Hydrosulphite of soda.

*For white wool and silk:* Permanganate of potash, bisulphite of soda, hydrosulphite of soda, perborate of soda, hydrogen peroxide.

Of the above bleaches, when viewed from the manner in which they attack stains, the most active is sodium hypochlorite, with permanganate of potash a close second. Perborate is the least active.

*Bisulphite of soda* may be had either in the form of a white powder or a colorless liquid, and is used for spotting purposes in combination with a small amount of sulphuric acid. The active bleaching agent is sulphur dioxide.

*Sodium hypochlorite, eau de Javelle*, is produced by the addition of a soda ash solution to a solution of chloride of lime. It is used for bleaching and spotting in the same manner as chloride of lime. A further description of *eau de Javelle* is given in another part of this work. On account of its destructive action on colors,

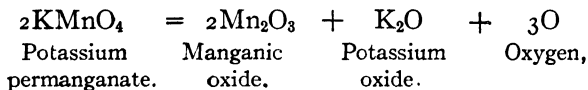
this product should be used only on white goods, it being practically impossible to remove a color stain from a light-colored garment with it without damaging the ground color.

*Perborate of soda* is especially to be recommended for the removal of perspiration stains. It has but a mild action on colors, a great many dyes being but slightly affected by it. When perborate is dissolved in water it splits up into hydrogen peroxide and borax or into free oxygen and sodium metaborate. However, in whichever manner it splits up approximately 10 per cent. of free oxygen is liberated. Perborate of sodium is a very efficient spotting agent and is capable of replacing the other peroxides and permanganates in the cleaner's work. Due to its properties and the ease with which it may be used, there can be no doubt but that it will come into almost universal use and replace many of the other chemicals that are now used for bleaching and spotting purposes. Stains caused by wine, grass, chocolate, coffee, and others that must be treated by an oxidizing agent readily yield to perborate. Stains caused by hair dyes, developers, iron inks, should not be treated with this bleach, as the oxidizing action tends to fasten these stains rather than remove them. Color stains on colored fabrics may generally be removed with perborate without damaging the ground color of the fabric.

*Bleaching with potassium permanganate* will first be considered. When a fabric of cotton, wool or silk is dabbed at the ordinary temperature of a room with the red solution of potassium permanganate, the latter

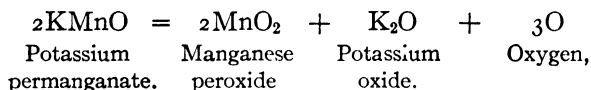
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is immediately reduced and a brown stain of manganese hydroxide is formed. The reaction can be expressed by the equation:



the manganese oxide combining with water to form the hydroxide.

In the warm, the reaction proceeds as follows:



the manganese peroxide in this case forming the hydrated peroxide by combining with water.

*Reducing effect of carbon dioxide.* If the brown stain be touched with a solution of sulphur dioxide (sulphurous acid), the bleaching effect of the potassium permanganate becomes apparent. The sulphur dioxide by its powerful reducing action deoxidizes the brown manganese peroxide or hydroxide, to manganous oxide or hydroxide, while the sulphurous acid itself is oxidized to sulphuric acid. The latter combines with the manganous oxide to form manganous sulphate, a nearly colorless salt, which can be readily washed out of the fabric with water, leaving the site of the stain bleached a pure white, and thus demonstrating the bleaching action of permanganic acid.

If the quantity of sulphurous acid used be too small,

it may happen that a brownish stain is left, because the permanganate has not been completely oxidized. An excess of sulphurous acid used must be completely removed by washing, or it will be gradually oxidized to sulphuric acid on the fabric, the fibers being then in time corroded and rendered brittle. This may occur at once if the fabric be ironed.

*Reduction with hydrogen peroxide.* By the manganic peroxide which, as previously mentioned, appears upon the tissue in the form of a brown stain, hydrogen peroxide is by mere contact action immediately decomposed to water and bleaching oxygen ( $\text{H}_2\text{O}_2 = \text{H}_2\text{O} + \text{O}$ ) an increased bleach being thus obtained.

It is also conceivable that an insoluble layer of manganic peroxide is formed upon the fabric which does not allow the complete decomposition of the excess of potassium permanganate used upon the fiber. It may further happen that the permanganate on coming in contact with hydrogen peroxide is reduced, so that subsequently the bleaching oxygen acts from two sides upon the stained portion of the fabric. The object of the addition of acid to the hydrogen peroxide is also to form a readily soluble salt with the manganous oxide formed by the reduction of the peroxide.

For the reasons mentioned above, sulphurous acid which in hydrogen peroxide is also rapidly oxidized to sulphuric acid and, at the same time, would absorb a large portion of the peroxide for its own oxidation, is not used in the modern method.



Formic acid and acetic acid which have been proposed, also undergo partial oxidation in hydrogen peroxide solutions, so that the mixture needs to be used in a fresh state. The action is, however, too slow.

In some establishments phosphoric acid and oxalic acid are also used. However, these two acids form, with manganous oxide, salts—manganese oxalate and manganese phosphate—which dissolve with great difficulty in water, and are even in very dilute solutions very difficult of removal from the fabrics by rinsing. The use of oxalic acid must be entirely rejected, because, independent of the fact that the combination formed dissolves with great difficulty, a portion of the acid is, on the one hand, lost, as regards the effect of the solution, on coming in contact with the manganic peroxide, carbonic acid escaping, while, on the other, oxalic acid may, under certain conditions, exert the same injurious effect upon the fabrics as sulphuric acid.

Phosphoric acid is not attacked by hydrogen peroxide and vice versa, and remains unchanged on coming together with manganic peroxide. Since phosphoric acid acts completely and fully as a solvent upon the manganous oxide and the acid phosphate formed dissolves with greater ease than the oxalate, its use may deserve consideration.

The above-mentioned subsequent treatment of the brown stain of manganic peroxide may be effected with pure hydrogen peroxide solution, or by peroxide liberated from sodium peroxide, or oxygenol by mixing with an acid.

*Reduction with hydrosulphurous acid.* In all cases where the use of sulphurous acid is not admissible, A. Seyda uses hydrosulphurous acid. It is prepared as needed, by shaking, for instance, 50 cubic centimeters of concentrated sodium bisulphite solution. diluted with the same quantity of water, with a knife-pointful of zinc dust. When reaction is complete, dilute the mixture with water, shake, and filter immediately through cotton. Add to the filtrate about 20 to 40 cc. of acetic acid together with 100 cc. of boiling hot water, and use the mixture as reducing agent. It may be remarked that hydrosulphuric acid in aqueous solution quickly decomposes.

Seyda gives a method suitable for spotting in the cold way, as follows:

1. A mixture of commercial hydrogen peroxide with an equal volume of 10 per cent. acetic acid immediately dissolves the manganous acid, relatively the potassium permanganate reduced upon the fabric.

2. A serviceable reducing liquor may be prepared from sodium peroxide as follows: Dissolve 100 cubic centimeters of dilute sulphuric acid (1 part acid to 5 parts water), one teaspoonful of sodium peroxide, add, if necessary, enough of the latter for the solution to show a slightly alkaline reaction, then add the same volume of 10 per cent. acetic acid and one teaspoonful of ammonium chloride. The chemicals should be added in the order given.

3. From oxygenol a reducing liquor is prepared as follows: Put in a glass of about 200 cubic centimeters capacity, 1 teaspoonful of oxygenol and 1

teaspoonful of ammonium chloride. Then add 100 cc. of water and 100 cc. of 10 per cent. acetic acid. The solution soon becomes clear. By the addition of ammonium chloride, the solution of the manganic oxide in the acetic acid is more rapidly effected.

The solution prepared with sodium peroxide acts more sluggishly than the oxygenol solution. The reason for this must be sought in the larger content of salt (sodium sulphate) by which the solution of even slight quantities of manganic oxide is perceptibly impaired. This also is the only explanation why with the use of hydrogen peroxide the addition of ammonium chloride may be omitted. The above-mentioned solution contains 5 per cent. acetic acid; it should not be stronger than this, as otherwise the colors are injuriously affected in spotting dyed goods. Formic acid may be used in place of acetic acid. By means of the described method stains of the most varying kinds can be removed from white and undyed fabrics, as well as from light-colored goods which have been dyed with rhodamine, alizarine blue and chrysophenine. If due care is not observed in spotting dyed goods it may happen that the dye-stuff is bleached together with the stain and the place treated appears white. The only remedy in such a case is re-dyeing the bleached portion with a suitable dye-stuff solution. The behavior of dyed goods towards hydrogen peroxide will be referred to later on in speaking of hydrogen peroxide as a spotting agent.

Bleaching with potassium permanganate is frequently employed in connection with other spotting agents.

As previously mentioned, bleaching is effected by dabbing the stain with potassium permanganate solution and dissolving the reduced manganese oxide.

*Combined method of removing stains.* *Obstinate stains* may be removed, especially from white goods, by the following method: First remove the fatty substances by means of a solvent, best carbon tetrachloride, and then moisten the stains, one after the other, without previous washing, with undiluted ammonia, oxygenol solution and oxalic acid solution. After the latter treatment, wash thoroughly, wipe off, damp with alcohol, especially with silk articles, and then dry completely. Only old stains withstand this treatment. To remove them bleaching with permanganate is made use of, hydrogen peroxide with acetic or formic acid (see above) being employed for after-treatment. This method is at present frequently used in the practice, though it may be objected to on the ground that the fabric is always endangered by oxalic acid. It has further been shown that brownish stains due to the action of light and air are after some time formed on the places treated with oxalic acid and oxygenol solutions. It would therefore be better to substitute in the first treatment formic or acetic acid for the oxalic acid.

*Use of Hyraldite in spotting.* Under the trade name of Hyraldite A a very stable combination of sodium hydrosulphite with formaldehyde is found in commerce. It forms a white mass, readily soluble in cold, as well as in hot, water, the solutions being very stable in a neutral, as well as alkaline, state. However, on the

addition of sodium bisulphite, acetic acid or any other acid, sodium hydrosulphite splits off, which shows energetic reducing action. On this property depends the use of Hyraldite A for stripping colors from dyed goods. This will be referred to later on.

Hyraldite is, however, also suitable for the removal of color stains. Dissolve a small quantity of Hyraldite—about the size of a walnut—in about 100 cubic centimeters of water acidulated with 15 drops of 10 per cent. acetic acid and previously heated to boiling. Colored stains disappear by dipping for a few seconds the portion of the fabric containing them in the warm solution. Another mode of operation is as follows: Place the article, for instance, a white silk waist stained under the arms with colored perspiration stains, upon a small steamer, damp the stains with Hyraldite solution, and steam. The stains will in most cases disappear. Either one of these methods is available for white goods as well as for fabrics dyed with rhodamine, alkali blue, and chrysophenine. Before attempting the removal of color stains from light or dark colored goods dyed with other dye stuffs, the behavior of the ground color towards Hyraldite should be tested. By means of Hyraldite solution of suitable concentration and with careful treatment, it will in most cases be possible to remove coloring matter mechanically adhering to the fabric without injury to the ground color.

It sometimes happens that in removing color stains from white goods with Hyraldite, yellow stains remain behind; these can be removed with warm Oxygenol solution.

*Hydrogen peroxide as a spotting agent.* Hydrogen peroxide,  $\text{H}_2\text{O}_2$ , is the combination richest in oxygen which exists between hydrogen and oxygen. A remarkable characteristic of hydrogen peroxide is the ease with which it decomposes to water and oxygen. Hydrogen peroxide is a colorless liquid of syrupy consistency and evaporates on exposure to the air; in slightly alkaline solutions it will keep for quite a long time.

Commercial solutions of hydrogen peroxide contain as a rule about 3 per cent. by weight of hydrogen peroxide corresponding to about 10 to 12 per cent. by volume. It contains sometimes, besides a slight excess of phosphoric acid, a small quantity of sodium sulphate, and a little magnesium chloride or sodium chloride.

By the addition of phosphoric acid and sodium chloride the stability of the hydrogen peroxide solution is improved. Hydrogen peroxide keeps best at a low temperature, in a dark place, and in the presence of small quantities of acid. Its stability is improved by the addition of about 15 grains of naphthalene or  $\frac{1}{3}$  oz. of alcohol to the quart.

In order to use commercial hydrogen peroxide (10 per cent. by volume) for spotting, prepare first a bleaching liquor consisting of equal parts of hydrogen peroxide and pure water. Heat the bath to nearly the boiling-point, compound it with sodium silicate till it shows an alkaline reaction, and then add a small quantity of white castile soap shavings. Dab the stains with this hot bleaching liquor till they are bleached. For

dabbing use a tuft of cotton wrapped round a wooden stick, as hydrogen peroxide makes white stains upon the skin. The moisture must of course, from time to time, be taken up with cotton, as otherwise too large a surface would be affected.

In spotting, hydrogen peroxide, to be sure, is mostly used for after-treatment, after potassium permanganate, but there are many cases in which it may be directly employed to advantage.

After the stained places have been treated with commercial hydrogen peroxide, it is advisable to hang up the articles for several hours exposed to light and air, frequently moistening them during this time, and then, after again moistening the stains with hydrogen peroxide, to dry the articles in a heated drying-room.

When by this method the stains appear sufficiently bleached, brush thoroughly with water and treat with dilute acetic acid. Then brush again thoroughly with water, and finally dry.

*Coffee and chocolate stains*, which resist other treatment, can be removed by repeated dabbing and slight rubbing with the above-mentioned preparation.

Sometimes, especially in the case of large stains, a few drops of the preparation should for a short time be allowed to act upon the stains, and the liquid then be taken up with cotton. With the use of pure hydrogen peroxide previous dabbing of the stains with ammonia, or an addition of ammonia to the peroxide is advisable. By the use of hydrogen peroxide solution compounded with ammonia, *grass, beer and milk stains*,

as well as *stains caused by fruit juices*, can be removed. After treating the stains, dry thoroughly, especially in handling light-colored goods, with a white woolen rag in order to avoid rings.

*Stains due to red wine* can be removed with hydrogen peroxide solution (without ammonia). For the removal of *blood stains* a hydrogen peroxide solution compounded with a small quantity of pure ammonia is very suitable. This solution serves also for the removal of *ink stains* by repeated dabbing, but in the case of iron inks previous careful dabbing of the stains with hydrochloric acid is required. *Rust stains* should be repeatedly dabbed with hydrochloric acid, whereby yellow ferric chloride is formed. The latter is removed as much as possible with cotton, and the remaining yellow stain is then dabbed with hydrogen peroxide until it disappears. Finally wash with water in the case of woolen, cotton, and linen goods; in the case of silk goods rub with some distilled water.

*Mold stains and yellow and brown stains*, such as are frequently found in white fabrics, can in many cases be removed with hydrogen peroxide; sometimes it may be necessary to first dab the stains carefully with dilute hydrochloric acid.

*Stains due to tar or axle grease* can in many cases be removed by treatment with the above-mentioned hydrogen peroxide solution, compounded with sodium silicate and soap, or hydrogen peroxide solution compounded with ammonia, and subsequent sponging with warm soap solution.

With the previously mentioned bleaching liquor, or



equal parts of hydrogen peroxide and water, stained *white gloves* may be cleaned. However, the following process may also be employed: First wash, for instance, white buckskin gloves, in a lukewarm fat castile soap bath and then rinse thoroughly in soft water. The gloves are then treated in a just foaming castile soap bath to which 3 per cent. hydrogen peroxide has been added. They are then extracted and slowly dried in an airy place. By the hydrogen peroxide a beautiful white is obtained on the leather, and the residual soap restores pliability. When dry the gloves can be rendered more supple by energetic rubbing.

Since the ordinary commercial hydrogen peroxide (10 to 12 per cent. by volume) cannot remove obstinate stains, a stronger solution is sometimes used in chemical cleaning, especially for ink stains and the yellow-brown markings caused by perfumes.

Owing to the bleaching action of hydrogen peroxide on dyes it is largely used for eradicating stains on white fabrics, but long experience has shown that its application is by no means restricted to this class of material.

*Behavior of hydrogen peroxide towards colored fabrics.* In the above-mentioned experiments a number of articles of wool, half-wool, cotton, silk and half-silk were exposed for a short time (the same as in spotting) to the action of hydrogen peroxide solution with and without the addition of ammonia. The colored goods stained, for instance, with ink or rust, also were in many cases carefully treated with hydrochloric acid and hydrogen peroxide solution in order to ascertain

in what manner a change in the shade of the color may take place.

Of the thirteen articles dyed with basic dye-stuffs those which had been dyed with Saffranine, Rhodamine, New Methylene Gray, Methylene Green, Indamine Blue and Malachite Green proved resistant, as they did not lose color by rubbing and no change in shades took place.

Although resorcline dye-stuffs, such as Eosine, Erythrosine, etc., cannot lay claim to fastness, the articles dyed with them showed neither loss of color with gentle rubbing, nor a change in the shades.

Of the thirteen articles dyed with acid dye-stuffs, those dyed with Acid Violet, Keton Blue, Patent Blue, Fast Acid Blue, Violamine, Fast Acid Violet, and Nigrosine, showed no loss of color, and no change in the shades was noticed.

Of the ten samples which were dyed with ten different nitro and azo dyeing stuffs, such as Azo Yellow, Bordeaux, Cloth-red, Fast Brown, etc., only the sample dyed with Fast Red suffered a slight loss of color by the action of the hydrogen peroxide in rubbing.

Of the fourteen articles dyed with mordanted dye-stuffs, such as Alizarine Blue, Alizarine Yellow, Alizarine Black, Coerulein, Acid Alizarine Green, etc., all proved resistant when rubbed after treatment and no changes in color took place, except the samples dyed with Alizarine Brown and Alizarine Green.

Among the dyes for wool intended to stand milling, those prepared with Anthracene Yellow and chromium fluoride or potassium chromate were tested as follows:

Hydrogen peroxide solution with an addition of ammonia was allowed to act on portions stained with ink. The stains disappeared without any loss or change of color on the part of the fabric.

From articles dyed with Milling Yellow and with Anthracene Acid Brown (mordanted with potassium chromate, ink stains (iron ink) were removed by treatment with hydrochloric acid and hydrogen peroxide; in the first case the color was changed by the hydrochloric acid to brown, and in the latter, to black. The original color was, however, restored by the action of the hydrogen peroxide. From articles dyed with Milling Red and with Wool-red, various kinds of stains were removed by means of hydrochloric acid and hydrogen peroxide without loss of color or a change in shades. A fabric dyed with Alizarine Blue was not changed by hydrochloric acid and hydrogen peroxide. Articles dyed with Milling Yellow, Alizarine Blue, Diamine Fast Red (with chrome potash), Wool-red, Anthracite Black, Anthracene Acid Black, and Anthracene Acid Brown (with chrome potash) showed themselves entirely indifferent towards the action of hydrogen peroxide (with ammonia), and there was neither loss of color nor change in shades. By treatment with hydrogen peroxide only about 23 per cent. of the tested articles lost more or less color by rubbing.

According to the results of the above-mentioned experiments, which on the whole are very favorable, hydrogen peroxide may also be used in spotting colored goods, provided due care is observed.

*Oxygenol as a spotting agent.* Oxygenol is an odor-

less white powder soluble in water, the solution showing distinctly an alkaline reaction. When dissolved in water Oxygenol yields its oxygen, and to increase the evolution of the latter, the temperature of the water used for solution should be between  $86^{\circ}$  and  $104^{\circ}$  F. By maintaining this temperature the oxygen is not too energetically evolved, and its bleaching effect is thus utilized to the utmost. If the solution is heated to above  $140^{\circ}$  F., the oxygen is evolved too rapidly, and at the boiling-point escapes entirely.

For spotting purposes Oxygenol is suitable only for the removal of stains from white articles. Many such stains can be removed by repeatedly treating them with Oxygenol solution heated to from  $113^{\circ}$  to  $122^{\circ}$  F., 2-5 to 1-2 oz. of Oxygenol dissolved in one quart of water being very suitable for the purpose. In the practice about 2 to 3 tablespoonfuls of Oxygenol to one quart of water are frequently used. In spotting, a mixture consisting of  $3\frac{1}{2}$  ozs. Oxygenol to one quart of water, and about  $\frac{3}{4}$  oz. of formic acid or  $3\frac{1}{2}$  ozs. acetic acid is sometimes used. It is suitable for carefully dabbing the stained fabrics at the ordinary temperature. It may also be employed for after-treatment (after the permanganate process).

When the removal of the stains with hot Oxygenol solution is not possible, strip them first with Hyraldite and then treat them with hot Oxygenol solution until they disappear.

*Fruit and coffee stains* yield quickly to hot concentrated Oxygenol solution; *cacao stains* disappear only after repeated treatment.

*Red wine stains* are first bleached with potassium permanganate and subsequently repeatedly treated with hot Oxygenol solution.

*Blood stains* are removed with comparative ease and in a short time. For the removal of *rust and ink stains* Oxygenol solution appears to be less suitable. On the other hand, it can be successfully used for getting rid of scorched places, yellow stains and edges in cotton fabrics, laces, etc.

As previously stated Oxygenol is chiefly used for the removal of stains from white fabrics. Since its solution, similar to that of hydrogen peroxide, exerts, according to its concentration, a more or less bleaching effect, dyed articles may be attacked by it.

*Behavior of Oxygenol towards colored articles.* To test the behavior of Oxygenol in this respect, experiments were made with dyed wool and cotton goods. It was found that, generally speaking, warm Oxygenol solution exerts a somewhat stronger bleaching effect than ordinary commercial hydrogen peroxide solution. Of cotton goods dyed with aniline colors only those proved quite resistant to lukewarm Oxygenol solution which were dyed with new gray indophenin, bismarck brown, new fast blue and new fast gray. Of woollen fabrics dyed with milling fast dye-stuffs, the action of Oxygenol solution heated to 113° F., which evolved oxygen quite energetically, was resisted only by such as were dyed with alizarine blue, diamine scarlet, wool-red, anthracene acid brown (with chrome potash), anthracene black; and anthracene acid black. Woollen goods dyed with milling yellow and with milling red proved quite

resistant when treated with Oxygenol solution, yielding but little coloring matter on rubbing, and those dyed with anthracene yellow and milling yellow showed still greater resistance even on rubbing.

The results of the above-mentioned experiments show that Oxygenol is especially suitable for the removal of stains from white fabrics.

*Sodium peroxide as a spotting and washing agent.* Sodium peroxide may be used in spotting in place of hydrogen peroxide. It is found in commerce in the form of a grayish-yellow granular powder, which readily dissolves in water with the generation of a considerable amount of heat and some loss of oxygen.

The bleaching liquor for spotting is prepared as follows: Pour  $\frac{3}{4}$  oz. of formic acid or  $3\frac{1}{2}$  ozs. of acetic acid into 1 quart of water, and gradually bring into this mixture, stirring constantly,  $4\frac{1}{4}$  ozs. of sodium peroxide. Allow the mixture to stand about one hour before use. It is used either directly or after potassium permanganate. Instead of this bleaching liquor, the following may also be advantageously used, especially for silk fabrics: Dissolve in 1 quart of soft or distilled water  $\frac{1}{3}$  oz. of epsom salt, then bring gradually into the solution, stirring constantly, 2 drachms of sodium peroxide, and finally add  $1\frac{3}{4}$  drachms of sulphuric acid. Determine accurately by means of litmus paper the reaction of the fluid; if too acid add a small quantity of sodium peroxide, or if too alkaline add a little acid until the fluid shows an entirely neutral reaction. Damp the stains with the hot liquor; the latter may also be used stronger.

Sodium peroxide is also used in washing, a suitable quantity of it corresponding to the number of articles being added to the wash-water in the washing machine.

With the exception of very obstinate dye stains, nearly all kinds of stains in clothes can be removed by the use of sodium peroxide. Care should be taken not to use too large a quantity of it, as otherwise the fibers of the fabrics may be weakened. On account of its greater content of active oxygen, sodium peroxide acts with greater intensity than Oxygenol. Color stains are best removed, before bleaching, by means of hot Hyraldite solution.

*Sodium peroxide soap.* Beltzer\* recently made public a method of preparing soap containing sodium peroxide, the production of which is based on the property of the peroxide for forming a stable dry mixture with anhydrides. The soap is made from acid castor oil, rosin, sodium carbonate and sodium silicate. The strongly alkaline soap powder is then completely dried and thoroughly mixed with dry sodium carbonate and sodium peroxide in a rotary mixer, the mass being finally made into cakes in a hydraulic press. This soap is intended for textile purposes, such as bleaching raw cotton, raw flax, ramie, jute, pelts and fur.

Insofar as the spotting operation is concerned, the cleaner finds the bleaches of the most importance for the removal of color stains. Many white and colored garments that have been stained with a dye under the influence of perspiration or rain are given up as hopeless of correction, when by the use of the proper bleach-

\* Chemisches Centralblatt, 1907, Band II, Seite 1871.

ing agent they may often be restored to their original condition.

The problem of removing colored stains must be studied from two angles: The removal of these stains from white goods, and their removal from colored goods.

Hypochlorite of soda is a very efficient bleach for removing color stains from white cotton garments. It is made as follows: One pound of chloride of lime is made into a paste with cold water and is then diluted to two quarts. Nine and one-half ounces of soda ash are dissolved in  $1\frac{1}{4}$  pints of hot water and allowed to cool. The two solutions are then mixed, well stirred, and the solid matter allowed to settle. The clear liquid is sodium hypochlorite. It should be drawn off and kept in tightly corked bottles. For the removal of color stains and for other spotting operations it should be diluted until it shows a strength of from 2 to 4 degrees Tw. The solution should be used cold and the operation carried out without any loss of time. When the stain has disappeared, the portion of the garment treated should be rinsed and treated with one of the so-called anti-chlors. A 3 per cent. solution of hypo may be used for this purpose.

Permanganate of potash and bisulphite serve very well for removing color stains from white wool and silk garments. Its characteristics and uses have been explained in a preceding portion of this chapter. When using permanganate as an agent for the removal of color stains it is good practice to dissolve a few crystals in cold water, add a few drops of sulphuric acid, and then touch the portions to be treated with a



clean stick dipped in the solution. After treating the stains, apply a 3 per cent. solution of bisulphite of soda, after which rinse well. This method may be used with safety on all classes of white goods.

Hydrosulphite of soda is very generally used to remove color stains from colored fabrics. It is on the market under a variety of trade names, among which may be mentioned, Kalol, Burmol, Hydrosulphite Concentrated, Hydrosulphite AZ, Hyraldite Z, and others. These compounds are of two classes, distinguished by the manner in which they work. 1—Those that exert their reducing action in a neutral or alkaline bath, and 2—those that are soluble only in acid baths and that exert reducing action in such solution. Those of the first group are generally used for spotting purposes; those of the second for stripping the color from entire garments. Those of the first group are not stable in solution and only enough of the powder for immediate needs should be dissolved. Hydrosulphite compounds should never be used on weighted silks as it turns them gray.

### III.

#### WET CLEANING.

PREVIOUS to wet cleaning, it is important to ascertain first the class of fibers of which the articles are made. It is sometimes very difficult for the operator to determine the nature of a fabric, and some directions for this are given in Section XI, "Analysis of Textile Fabrics."

An article made of wool is comparatively easy to wet clean providing one understands the work. But many fabrics are now used in the manufacture of ready-made clothing which are composed of a mixture of cotton and wool in varying proportions. Sometimes the two fibers are mingled together in the same thread; at other times there are interwoven threads of cotton and wool. Then again there are fancy fabrics in which part of the decorative effect is obtained by using silk, cotton, artificial silk and wool threads in a manner which is detrimental to successful wet cleaning. The main object of the manufacturer of these fancy articles is to employ the cotton threads in preference to silk. The latter is employed only for the purpose of deco-

ration. These goods offer great difficulties to the cleaner and should always be dry cleaned.

The wet process of cleaning garments is fairly straightforward work, but nevertheless great care is required, and the process has to be modified to suit the color and the material of the particular garment being cleaned. The two great dangers which must be guarded against are the liabilities of damaging the color and shrinking the fabric. There are two general methods in use for setting colors before commencing cleaning, although neither may be relied upon under all circumstances. The colors on cotton goods may sometimes be set by soaking in a salt-water bath. For this purpose use four ounces of common salt to each gallon of water. For setting colors on wool and silk acetic acid is used in the proportion of one ounce of acid to three gallons of water.

The best grade of soap to use for wet cleaning is a neutral soap which has either a soda or a potash base. There are many commercial preparations such as Universal, Tetrapole, etc., which may be used to good purpose on delicate articles. Soap-bark is also used. The perfect solubility in water of the soap is of vital importance; it means that it can be used cold and rinsed with cold water, but for this purpose warm rinses are advised. Cold soap liquors agree better with the colors of many fancy articles than hot liquors, as the latter may cause the colors to bleed, and the colors may fix themselves on other parts of the garments.

One of the greatest faults in the process of wet cleaning of colored goods is interruption of the work.

This should not be tolerated when, as is often the case, the goods may be waiting to be extracted, or left for hours in the last rinse bath under the mistaken idea that they are safe by the time they have been hardened, and then left in a cold-water rinse. Many dyes which hold well in soap bleed in water, and spread to other parts of the same article, or even to other articles in contact with them. It is anything but uncommon for goods to come faultless from the soap washing, and to show all manner of dye stains after rinsing. Time and trouble are both saved by the goods when once their treatment is begun, being finished with the greatest possible expedition. If there is any tendency towards shrinkage the process should be carried out at as low a temperature as possible. Also rough treatment of woolen goods should be avoided so as not to cause felting.

A very important point in wet cleaning is:

*Water.* It should be pure and soft and especially free from lime and iron. Soft river water and rain water are most preferable to use, as well as distilled water such as collects in large establishments where steam power is used, although in this case it must be free from oil and grease. Turbid water holding solid substances in suspension must be clarified before use by filtering or settling. In practice impure water may be boiled with bran and the dirty scum formed skimmed off. Hard water containing lime and magnesia salts cannot be used for wet cleaning. These salts have the property of decomposing the soap which is used and forming with the fatty matter of the soap

insoluble lime and magnesia soaps, which are precipitated out of the water in the form of curdy masses that settle on the fibers of the fabrics and often impart to them a spotty appearance.

Water to be used for cleaning and bleaching should be free from iron. With the use of water containing iron the fibers can never be suitably cleaned and bleached, even the smallest content of iron imparting to the fabrics a yellowish tone; wool especially turns readily yellow.

*Purification and testing of water.* A simple method for testing water as to its softness is as follows: Dissolve a small quantity of good pure soap in alcohol and allow a few drops of the solution to fall into the water to be examined. If the water becomes milky or turbid, it is hard; if it remains clear or becomes only slightly turbid, it is soft. If soap chips added to boiling water dissolve completely in it, and a clear soap water is formed after cooling, the water may be used without hesitation; if, however, after cooling, the soap forms a curdy layer on the surface, the water is hard.

The mere appearance of water is of no value in judging it, since even crystal-clear water may to a high degree be saturated with gypsum. The purity of water also varies with the season of the year, the content of lime being greater in summer.

For the determination of the presence of *gypsum* add to the water 2 or 3 drops of hydrochloric acid and 10 drops of barium chloride solution; the formation of a precipitate indicates the presence of *gypsum*.

The presence of *chlorine combinations* is indicated if a precipitate is formed on adding to the water 2 to 3 drops of nitric acid and the same quantity of nitrate of silver.

To test for *ammonia* add to the boiling water 10 drops of caustic potash solution; if a piece of red litmus paper held over the boiling water turns blue, the water contains ammonia.

*Nitric acid* in water is detected by evaporating the water to be tested to half its quantity and adding a few drops of sulphuric acid and a small quantity of indigo solution. The water contains nitrates if on heating it the blue color disappears.

The presence of *lime* is tested by mixing the water with ammonia until it smells of the latter and then adding a little ammonium oxalate; if a precipitate is formed the water contains lime.

To test for *iron* add to the water a few drops of nutgall tincture; if a blue-black precipitate is formed it is due to the presence of ferric oxide.

A distinction is made between transient and permanent *hardness*. If bicarbonate of lime predominates, which by mere boiling separates as carbonate of lime, transient hardness is indicated. On the other hand, permanent hardness exists if sulphate of lime, which does not separate in boiling, predominates. The degrees of hardness are accurately determined by means of a standard soap solution, but the test has to be made by an expert chemist.

By simply allowing hard water to stand quietly for some time, precipitates are formed, which become

more apparent on boiling. If after standing for a longer time the water deposits a brown skin on the sides of the vessel, it contains iron and is unsuitable. To test the hardness of water mix about a pint of it with tincture of soap obtained from the druggist; the greater the content of lime and magnesia salts is, the more turbid the water will become. By boiling a sample of the water which has been found to be hard by the reaction with tincture of soap, over an alcohol lamp, it will become turbid, and after cooling a precipitate of carbonate of lime and carbonate of magnesia settles on the bottom of the vessel. By decanting the supernatant clear fluid and adding tincture of soap to it, further turbidity indicates the presence of gypsum.

Hard water is, as a rule, softened by the addition of soda as follows: After adding the soda to the water, stir thoroughly and allow the whole to stand over night. The next morning take a sample in a clean, clear glass and add a little ammonium oxalate. If the water becomes milky, it has not been sufficiently softened and more soda has to be added.

For the purification of water in which gypsum predominates, use soda and caustic soda, the process being best effected at a boiling heat. Independent of alkali salts, water to be used for cleaning should not contain readily-soluble salts of the metals of the alkalies and of the metals of the alkaline earths.<sup>\*</sup> Thus, for instance, magnesium sulphate, magnesium chloride and aluminum sulphate should not be present.

The purified water may be tested as to its availability by dipping in it a small piece of red litmus

paper; the latter should turn only very slightly blue. When mixed with ammonium oxalate solution, no turbidity should appear.

Water containing iron may be purified by exposure to the air, the soluble ferrous iron combinations being oxidized by the oxygen of the air and converted into insoluble ferric iron salts. If chemicals are to be used, an addition of milk of lime is the cheapest and most effective means.

For the purification of water which contains iron and lime, it is advisable to mix it first with lime solution and then with soda solution, and allow the precipitate which is formed to settle, which requires about three hours. The precipitate contains lime and ferric oxide.

In all doubtful cases it is, however, advisable to have the water tested by an expert chemist.

Wet cleaning may, generally speaking, be divided into hand cleaning and machine cleaning. For hand cleaning a series of earthenware or wooden vessels of various sizes are required, as well as slate or marble slabs for hand-brushing. For machine cleaning the ordinary rotary washing machine is employed. There are various well-known types of this machine and it is not necessary to enter into a detailed description of them. The greater part of the wet cleaning work is best done on a slab with a brush, using the machine, if desired, for rinsing. When cleaning curtains or other articles of a delicate nature in the rotary washer, it is advisable to inclose them in a net or a muslin bag, so that they will not be damaged.



For rinsing blankets, etc., a series of wooden vats with a pair of squeezing rollers between each pair are handy, and for starching curtains, etc., a starch trough with a pair of rubber-covered rollers.

*Wet washing of men's woolen garments.* A properly wet cleaned suit of clothes must have a good appearance, be properly smoothed and ironed, must not smell of soap, dirt, or acid, have the proper feel of the material, its original color unimpaired, as also that of the lining, and show no pale seams and button-holes. The first thing to be done with this kind of cleaning is to sort it, putting on one side the garments to be wet cleaned, and on the other those for which dry cleaning is preferable. The sorting requires great experience to identify goods which would suffer in appearance or color by wet cleaning and not come out like new clothes. Dress clothes, colored waistcoats and most uniforms, must be chemically cleaned. Many other coats and even waistcoats, however, either on account of the way they are made or of the liability of their material to shrink and wrinkle, cannot be cleaned wet.

The first thing to be done with the goods intended for wet cleaning is to baste down all padding, so that the garment will not lose its shape, and to remove all articles that may have been left in the pockets.

Dark garments are wet cleaned with soda, light ones with soap, except in the case of dark waistcoats, which are soap scoured for the sake of the lighter lining. The articles to be wet cleaned with soda are then placed in a lukewarm solution of soda, the dirtiest

garments at the bottom. The sleeves and pockets are next turned, but trouser legs are left inside out, and the garments are brushed over on both sides with lukewarm soap water. If dark pocket linings are left hanging out over a light coat, the lining easily stains the material of the coat, especially in the washing machine. The soaping is continued till a permanent lather remains on the clothes. Neglect of this precaution will cause the finished washing to have a greasy and disagreeable feel. After the brushing over with soap, the goods are passed through a lukewarm, weak soda solution, and next through cold water, and are then extracted. After extracting, most of the soap and dirt will have been removed. The goods are then passed twice or three times through clean water and placed in cold water to be soured. This souring is a very important step in the operation, as it gives a fresh appearance and a good feel to the finished goods, and prevents any troubles with the linings due to the bleeding of dyes.

The souring is done with acetic acid, the bath being used lukewarm to make it penetrate the fabric more readily and more uniformly. According to the thickness of the cloth, the acid is added for each lot in one, two, or three portions. This again is a most important precaution. If with thick heavy fabrics all the acid is put in at once, it often happens that the finished goods still smell of soap and have a hard feel, while the faded parts of them stand out more clearly, and the seams look much lighter than the cloth. All this is avoided by adding the acid in por-

tions. Garments with black cotton linings are soured last, as they always bleed a little in the process. Waistcoats with dark linings may also be placed, after cleaning and rinsing, in salt water to prevent the black dye from bleeding. After souring, the goods are rinsed first in warm, and then in cold, water. If any acid is left in the garments they will be unnaturally stiff and have a hard, unpleasant feel. Thorough rinsing is especially necessary for light-colored goods in order to insure clearness of the colors, and it is advisable to treat them after souring for 10 minutes in a washing machine with clean, lukewarm water, then pass them once more through water, and extract.

Cloaks, heavy overcoats for men and servants are washed with soap and are treated differently from suits.

Gray uniform cloaks can rarely be cleaned with benzine, as the street dirt often adheres so strongly that only soaping will remove it. Very dirty places should be brushed over with a benzine soap solution before the garment is washed as a whole. The lining requires just as careful treatment as the cloth, especially in places particularly subject to be soiled, *i. e.*, which come into contact with a horse or with boot-tops.

Nearly all the articles just referred to are of heavy material from which it is difficult to rinse the soap completely. They are also too large and stiff, for the most part, to be easily wrung. They should therefore be extracted and then passed through warm, and next through cold, water, and then again through the extractor, till the water comes clear from the machine.

These goods are soured as already described, but in the case of heavy garments two persons are required to look after the wringing. The rinsing is done in three baths, the first two warm, the last cold. If a very soft feel is wanted, the final rinsing before extracting must be in soft water.

Men's dark clothes, like light ones, are soaked in soda solution, the darkest underneath and then brushed over with fresh soda solution. To prevent bleeding onto the linings the goods are now slightly soured and rinsed once cold. The souring removes the disagreeable rancid smell often acquired from the body, and which, if it occurs on a single article, would otherwise infect the whole batch.

Many operators prefer cleaning men's dark clothes with quillaia bark. Dark one-color articles such as brown, dark blue, dark green, olive and black, as well as all dark mixed goods which do not contain green or other delicate colors, are first soaked in a cold weak soda bath. Great care must however be taken that mixed goods containing bright colors, especially green and tobacco-brown, do not come in contact with soda or soap. By paying close attention, the workman will soon learn which articles may be soaked and which cannot be thus treated. Articles the colors of which are liable to run are not soaked at all, but simply moistened.

The quillaia bark is scalded with hot water—2 lbs. of bark to 3 bucketfuls of water. The whole is then allowed to stand to clarify, only the clear, yellow liquid being used. Of this extract add about 2 to 3

quarts to a bucketful of lukewarm water, or enough for the bath to froth well. The efficiency of the bath is increased by the addition of a whiskey glass full of ammonia. For green and green-mixed articles add to the bath a small quantity of acetic acid. For very delicate blue colors a few drops of sulphuric acid may be added to the bath without decreasing its efficiency. In this manner the baths may be so prepared that even the most sensitive colors are not impaired.

After cleaning and rinsing, the goods are passed through water soured with acetic acid. Articles which contain black cotton, as is frequently the case with mixed goods, are brought into salt water, as well as waistcoats. If the colors of the latter goods have already run, draw the articles quickly through a bath slightly soured with sulphuric acid, rinse well, and then place them in salt water.

The quillaia bark may be scalded three times in succession before it has yielded all its washing substance.

Since by cleaning with soap or quillaia all stains cannot be removed, it is advisable to get rid of them as much as possible by suitable means before washing. An excellent mixture for this purpose consists of 1 oz. each of acetic ether, ether, chloroform and carbon tetrachloride. Oil-paint stains are either softened with turpentine or fat, or removed with chloroform. Varnish, wagon grease and tar stains are also softened with turpentine; stearine, paraffine, and resin with alcohol.

If in men's colored garments spots are found where the color has been destroyed by urine, moisten them

with pure decoction of logwood, allow to dry, moisten once more, and after again drying, dab the spots with copperas solution; when dry, brush with a sharp brush. If the stains do not disappear by this treatment, moisten them with wine vinegar.

In all cases where garments are very dirty it is well to soak them for  $1\frac{1}{2}$  to 2 hours in cold water, either with or without the addition of 1 oz. of sal soda per gallon of water. This treatment softens the dirt and makes its removal easier. When taken from the soaking-bath the garments are squeezed to remove the surplus water, placed flat on a table, and scrubbed with a brush dipped in a neutral soap solution. Those portions of the garment most liable to soil should be given particular attention. After scrubbing, the garment should be given several rinses through warm water to remove the soap. If 1 oz. of acetic acid is added to each gallon of water comprising the last rinse the finished garment will have a better feel and appearance than if this detail were omitted.

Most wet cleaners treat each separate article of men's wearing apparel as follows:

*Coats.* The inside of the lapels, the inside of the collar and the sleeves are scoured in the order named. The remainder of the outside of the garment is then treated. The sleeves are then turned wrong side out and the entire lining cleaned. The garment is rinsed without turning back the sleeves.

*Vests.* The inside is scrubbed and then the outside.

*Trousers.* The outside is scrubbed first. The gar-

ment is then turned wrong side out and the lining, the bottom of the legs, and the remainder treated in the order named.

If there are any doubts about the fastness of the dye with which an article is colored, no soap should be used in the cleaning process. If a color should commence to run under the wet treatment the garment should immediately be rinsed in warm water and placed in a bath of Glauber's salt and alum to set the color. Articles dyed red often bleed when cleaned in warm water, and these should be watched carefully. Garments dyed red, which show a tendency to bleed, should be cleaned in cold water to which a small amount of common salt has been added to set the color.

*Wet cleaning ladies' garments.* In many establishments ladies' garments, no matter whether they are to be scoured with soap or quillaia, are first chemically cleaned, but the articles intended for wet cleaning are not passed through a fresh benzine bath. For dark articles, such as red-brown, brown, green, blue and black garments, which cannot be subjected to soap washing, such treatment is indispensable. However, it can also be highly recommended for light-colored articles, as the dirt dissolves more readily in the subsequent wet cleaning. If articles containing oil stain are only wet cleaned, the stains, which can rarely be entirely removed with soda or soap, appear again in a few days and become immediately perceptible by the adherence of dust.

Ladies' colored garments, for instance, with red,

blue, green, brown, etc., are spread upon a table, brushed with dilute alcohol, patted dry with a piece of buckskin, and hung up on two hangers.

The first qualification for the operator who has to deal with colored cotton garments is a knowledge of dyeing. No mistake is so easily made and no mistake is so difficult to remedy as that involved in treating colored cottons without regard to the dyes they contain. An enormous variety of dyes are in current use on cotton articles. Many of them bleed even in cold water, and many do not bleed in the presence of soap. It is, therefore, essential to test doubtful articles with soap. A trial may be made with a corner or inside seam, or by cutting a small piece from the band, and, after washing and drying, compare it with the garment. If the color has faded or become duller, it is best to chemically clean the garment. However, generally speaking, cotton articles do not become sufficiently clean by the dry method.

It should also be borne in mind that when a fabric is parti-colored, even if there are only two or three different hues, that at least one of the dyes used is almost certain to loose. In this case the general appearance of the goods must be considered. If the prevailing colors are dark, they must be treated with a lukewarm, but strong, lye of quillaia, to which it is advisable to add a little ammonia, especially when there is black in the pattern. It must be remembered that the detergent power of quillaia is far greater than that of soap, which partly compensates for the difference in price, and makes it worth while to use the



extract for cleaning expensive goods where a higher price for cleaning can be charged.

Wash-fast garments are placed upon a table, and the dirty places, especially the hem-lining, which is frequently soiled with street dirt, thoroughly brushed with cold soap water. They are then washed successively in two cold soap baths which should well lather, next rinsed and soured.

For cotton garments which will not stand cleaning with soap, the following process may be used to advantage: Scald a few pounds of wheat bran with boiling water, allow to stand and cool to 100° F.; then stir thoroughly and pass the whole through a hair-sieve. In this slippery milky liquor wash the articles either with the hand or upon the wash-board, finally rinse, extract, and hang up to dry. Fine black and white checkered cotton garments may in this manner be successfully cleaned, as well as all articles with delicate colors, the most sensitive colors being in no way injured. The colors do not bleed, since such bran extract does not contain any solvent substances, but much gluten, in consequence of which articles thus cleaned do not require further finish. Rapid drying is advisable.

A similar method is as follows: Bring quite hot water into a copper kettle and add wheat bran in the proportion of  $\frac{1}{8}$  of the weight of the articles to be cleaned. Let the whole draw for 5 minutes, then boil for 10 minutes, allow to cool, then enter the articles and bring slowly to the boiling-point, working the articles constantly. Then allow to cool slowly

to 77° F., next wash the articles thoroughly and rinse twice. Cotton articles thus treated turn out perfectly clean, and the colors retain their original freshness.

The colors of fabrics containing white silk together with black cotton are very apt to run; this is prevented and removed by placing the articles, immediately after washing and rinsing, in salt water for one to two hours, then at once starching, extracting and quickly drying. Such articles may be washed with soap or quillaia, or wheat bran, according to the degree of dirt; wheat bran, however, being always the safest agent.

*Corsets.* First remove the steels and soak the article in a 5 per cent. solution of oxalic acid until the rust stains are removed. Rinse out the acid and wash in warm water. When clean, rinse, dry and replace the steels.

*Ladies' half-wool and wool garments* are, as a rule, dyed with fast colors. However, on account of their shape, some of them cannot be wet cleaned, but have to be dry cleaned and freed from stains, while the colors of others will not stand soap washing, though the shape of the garments might permit it. When it comes to mixed colors, either woven or printed, one of the colors is sure not to be fast. Such pieces should first be dry cleaned, and then finished in a cold solution of quillaia bark (about 1 or 2 quarts to a bucketful of soft water). They are then rinsed and soured with acetic acid. Dark blue and dark green garments are treated in the same manner, a few drops of acetic acid being, in the latter case, added to the quillaia solution.

A preparatory chemical treatment will also be necessary for garments suitable for wet cleaning, but which contain a number of grease or other fatty stains. After the benzine bath, these pieces take wet treatment very well.

Wool and half-wool stuffs are best washed upon a table with a wood or slate top. It is an old rule that soapsuds used on woolens should not be too strong nor too hot. Only hand-warm, and even less is the proper temperature, and if the suds are light and foamy, the bath will be of sufficient strength. A proper brush is another matter of importance, for nothing is more foolish than to apply a coarse-fibered brush to a delicate costly fabric.

Black and white checks in wool and part wool should, before being wet cleaned, be taken through a bath consisting of pure water and a little common salt. After being dried they are wet cleaned in the usual manner. After rinsing allow them to remain for a short time in a solution of common salt, and then dry quickly in the air.

Rinsing plays a most important part in wet cleaning. Four baths are usually necessary to insure a proper rinsing. The first lukewarm, with a slight addition of soda; the second and third, plain warm water. After being thoroughly rinsed in these three baths, the garments should for some time remain immersed in the last cold bath. If white and light-colored pieces have not been sufficiently rinsed and still retain some soap, they will be marked with yellowish streaks after they have dried.

To freshen up the colors, which generally fade a little under the soap process, a warm water bath should be prepared in a clean wooden vessel and enough pure sulphuric acid added, while constantly stirring, to give the bath a faint acid flavor. All but black pieces should be taken through this bath, then rinsed and extracted. Black articles require a bath of common salt.

*Garments made of unweighted silk* are very durable and present no difficulties if proper care is taken. Cheap weighted silks, however, often cause trouble even as early as the second cleaning. They lose their color and tear like paper. When silk is weighted with tin it is absolutely necessary to wash it with perfectly neutral soap, as it is highly sensitive even to the least traces of alkali, and no guarantee can be given in the case of silks which have previously been washed elsewhere. The tin loading dissolves in hot soap lye and forms an insoluble thin soap, which acts severely on the fiber by mechanical abrasion during the cleaning, wherein it is powerfully assisted by any dust that may be present. Hence, it is advisable to free all silk from dust before washing, and that by the hand, as the use of a stick will cause too much friction between the dust and the fabric. Cheap light-colored silks must never be washed with those of darker colors, or the latter will almost surely bleed on to them. The stains so caused are very difficult to remove, especially as the fabric is generally very fragile.

All artificial silks, and particularly such as are weighted, must be washed in cold water, and with

absolutely neutral soap. Careful washing, if these conditions are rigidly observed, will do very little, if any harm, although care must be exercised, as all artificial silks are much weaker when wet, and when in this condition are easily damaged. As the soap must be neutral the use of soda is obviously inadmissible. The goods must have a good soaking in the cold soap, best overnight, and should never be rubbed, but stirred about sharply until the dirt is loosened and removed. It is an excellent plan to use gall soap as well as ordinary soap, say 2 lbs. of gall soap to every 4 lbs. of the other. The soap should be dissolved separately in warm water before adding it to the bath of cold water, and the silks put in immediately afterwards. On lifting, the goods are drained as much as possible, as wringing is to be deprecated, and then rinsed, drained again, and dried. This final process must be conducted with great care and at a very moderate temperature. If the warm air passes through the drying-room in sufficient volume the drying will not be too slow. Hot drying makes tin-weighted silk as stiff as a board and the evil cannot be remedied by ironing.

Dark-colored garments are never so tender as heavily loaded cheap silks, and the chief risk during washing is stripping of the color. After dusting, the garments are soaked in clean, warm soft water in which borax has been dissolved to the amount of about 1 lb. for every 12 gallons of water. Borax is chosen because it entails less danger to any loose dyes that may be present than most other substances. The washing is done with gall soap, previously dissolved

separately and added to the water before the goods are entered. There is no objection to washing in the ordinary washing machine, but the temperature must not exceed 75° F. The cleaned goods are drained, lightly extracted, and the color is brightened in an acetic acid bath. This bath also serves as a rinse and is used cold.

A good plan for protecting light-colored silks from stripping is to steep them in sour milk and soft water, first soaping any stains or very dirty places. After two or three hours' soaking the goods are washed with a liquor prepared by dissolving about 1 lb. of Marseilles soap and 5 ozs. of borax in 1 gallon of sour milk.

Perspiration stains under the armpits, if they resist soaping, may be removed by the cautious local use of sodium perborate, a powerful stripping agent.

After washing, the silks are freed from the sour milk by three or four good rinses in soft, lukewarm water. It is important that no trace of the milk should remain. If it is then found that the color has paled the goods are re-dyed. A small quantity of a suitable dye is placed in a gauze bag and hung in the water. When sufficient has dissolved, the goods are entered. After a few minutes lying fully spread out in the dye-bath they are lifted, drained, rinsed with cold water and dried at a moderate heat as above explained. If only a little re-dyeing is required, the goods are left in the dye for a correspondingly short period, or the rinse water used to remove the milk may be slightly dyed. The following are one or two especially useful dyes: Brilliant Geranine,

Benzo Orange S. and Brilliant Lanafuchşine. The last is fast to light, washing and stoving, and is used in a soap bath broken with sulphuric acid.

If the shape of *raw-silk garments* permits, they are, after removal of stains, washed quite warm, with soap bark or Tetrapole solution and rinsed in an acetic acid bath. A brush with stiff bristles should not be used on account of the danger of injuring the fabric. In many instances it is advisable to do away with the use of a brush altogether and to use a sponge instead.

With luster and barege garments great care has to be taken. While they stand wet cleaning, they frequently become very curly and shrink, so that they cannot be again smoothed by ironing. Such garments should not be washed on the wash board, but simply brushed and treated entirely cold, and also cold starched.

If garments trimmed with black velvet are wet cleaned like white articles, they should, after cleaning, be only drawn through acetic acid, or not at all soured, and starched. If, however, the fabric requires starching, the velvet, when the garment is dry, should be steamed and treated with a sharp brush. Finally, to restore luster and softness, rub the velvet with a small rag moistened with olive oil. This, of course, has to be done very carefully so as not to touch the fabric and soil it.

*Wet washing white wool and white silk fabrics.* Previous to washing white wool and white silk articles, such as cloths, woolen covers, jackets, silk shawls, etc., remove all metallic hooks and buttons. Then soak

the articles for half an hour in a lukewarm bath containing about  $\frac{1}{2}$  lb. of soda in solution. Next prepare two baths with soap which should lather well, and successively clean the goods in them. Cleaning is effected by squeezing below the surface of the bath the smaller articles such as fichus, etc., and shaking them; they should never be rubbed between the hands. Larger articles, such as blankets, etc., are cleaned either upon the wash board or in the washing machine. Good castile soap should be preferably used. The suds should only be lukewarm and never allowed to get too hot or too cold. To the last soap bath some blue is, as a rule, added. For this purpose dissolve in an earthenware vessel 2 to 4 ozs. of indigo carmine and add a few drops of the solution to the bath. After having passed through the last soap bath, the articles are wrung out or extracted, and bleached if necessary.

A suitable sulphur bleaching chamber for woollens should have walls and floor of brick-work set in cement, and be ceiled with planks thickly covered outside with felt. Wooden pegs should be used for the ceiling instead of iron nails, to prevent all chance of rusty water dripping on the goods to be bleached and staining them. Just below the ceiling laths cross the chamber, being supported on wall brackets and thickly tinned hooks are screwed into the underside of the laths for suspending the articles to be bleached. They are so placed that when the goods are hung upon them, the sulphurous acid gets all around each article. Hence the hooks have to be spaced according to the size of the articles, some laths being reserved for large,



and others for smaller, ones. From garments to be bleached, brass hooks and eyes and pins have to be removed before bringing them into the chamber.

When all the goods are hung up sulphur is set fire to in an iron pan and put into the chamber. The airtight door of the chamber is then closed, and the goods are left overnight. It is usual to burn half an ounce of roll-sulphur for every 10 cubic feet of the capacity of the chamber. The oxygen in 10 cubic feet of air will burn more sulphur than this, but if the quantity given above is much exceeded solid sulphur is apt to be sublimed on to the goods, and its removal is a matter of great difficulty.

Small pale yellow sulphur stains can be readily removed from the articles while still moist, by gentle rubbing with solution of oxalic acid in water; dark, nearly brown stains can, however, be scarcely removed. If, in sulphuring, the articles turn yellow, and the sulphur is not completely consumed, spontaneous renewal of air is lacking.

*Another method is as follows.* Do not blue after cleaning, but only when the articles have been sulphured. Then rinse them in lukewarm water and next in a warm bath to which a few drops of indigo carmine solution and cochineal decoction have been added.

White woolen blankets with blue or red borders can be sulphured without damage to the colors and then treated like other white articles.

A more convenient, though somewhat more expensive, bleaching process is that with potassium

permanganate and sulphurous acid. For this purpose fill an earthenware vessel with cold water and dissolve in it about 1 oz. of potassium permanganate. Move the articles in the solution for about 10 minutes so that they show a brown appearance; then press them out thoroughly and bring them into another earthenware vessel containing a fresh water bath with about 2 quarts of sulphurous acid. In this bath the articles should remain overnight. The two baths should be well covered to preserve them for further use. The next morning the articles are taken from the sulphurous acid bath, passed rapidly to a bath soured with sulphuric acid and to which a few drops of methyl violet 6 B have been added, sufficient to give the bath a pale-green color. The articles are finally rinsed and extracted.

*Bleaching white wool or silk articles with peroxides.* When the articles have been cleaned in the above-described manner, they are passed, for the removal of soap, through two lukewarm baths and thoroughly squeezed out. Prepare in an earthenware vessel a cold-water bath containing one part hydrogen peroxide for every 15 parts of water. Place the goods in the bath and allow them to remain in it for one-half to one hour, according to requirement, taking care that every article is below the surface of the bath so as to be thoroughly saturated. Cover the bath. When taking the articles from the bath squeeze them superficially and hang them in a room through which a current of air passes and the temperature of which does not exceed 68° F. The bleaching process takes

place together with evaporation. The saturated articles may also be exposed to the direct rays of the sun, whereby the process is accelerated.

Since hydrogen peroxide is for the sake of durability brought into commerce slightly acidulated, the bleaching bath must, before use, be neutralized by the addition of a few drops of ammonia. The baths should be well covered for future use, and brought up to the required strength by the addition of fresh hydrogen peroxide. The latter should be kept in well-closed vessels in a cool place.

*Bleaching white woolen blankets, garments, etc.* The articles, thoroughly freed from dirt and other impurities by wet cleaning, are extracted and then bleached. For this purpose old tubs which are not thoroughly clean should never be used; even with new tubs it is advisable—and this applies to all wood utensils used—to bleach them before use with a one-half per cent. hydrogen peroxide solution to withdraw the coloring matter contained in the wood. Water and acids must be free from iron; even water, otherwise suitable, which has stood for some time in an iron conduit, may contain iron and be thereby rendered unfit for use. Fill a wooden tub with cold, pure, soft water, add for every 10 parts of water one part hydrogen peroxide, as well as a small quantity of ammonia, stir thoroughly, introduce the articles and allow them to remain until they have acquired the desired tone of purity. If after bleaching with hydrogen peroxide the articles are not to be blued, it is advisable to dry them in the sun in order to complete the bleaching process. Bluing, if

required, is effected in a fresh, cold, or at the utmost, lukewarm bath with aniline blue or methyl violet. The goods are then immediately extracted and dried. It is best, if possible, to dry such articles in the open air in the shade; in drying in the drying chamber, care should be taken to do it slowly at a low temperature and with good ventilation.

Hydrogen peroxide is an excellent bleaching agent, but its bad keeping properties restrict its usefulness. As previously mentioned, the commercial article is, as a rule, slightly acidulated, such mineral acids as hydrochloric and sulphuric, and one or two strong organic acids, especially acetic, having been found efficient in increasing its durability. Addition of one of these makes even weak solutions of hydrogen peroxide keep fairly well. For many purposes, however, the use of acids with peroxide is objectionable, and several other efficient preservatives have been discovered. The chief of these are benzoic acid, phenacetine, and lactophenine. A solution of hydrogen peroxide of 3 per cent. strength decomposes so spontaneously at the ordinary temperature that it loses half its strength in from one week to a fortnight, according to the weather. When mixed with from one-half to a whole gramme of benzoic acid to the quart, again according to the weather, the peroxide will still have six-sevenths of its original strength after the lapse of a month. Phenacetine and lactophenine have a still more powerful preservative action. From 1-5 to 1-4 of a gramme of them is as effectual as a gramme of benzoic acid. Even with 1-20 of a gramme per quart, of either

phenacetine or lactophenine, half the original strength of the peroxide often remains after the lapse of a month. Having regard both to efficiency and to economy, phenacetine is the best preservative for hydrogen peroxide, and in no way interferes with its industrial action.

As a substitute for the not very constant hydrogen peroxide, sodium peroxide may be recommended as a bleaching agent. Its use for white silk, especially ribbons, is as follows: Rub the silk gently with a medium hard brush and hand-warm soap solution, so that the threads of the tissue are not pushed together. Then rinse thoroughly in water of  $86^{\circ}$  to  $100^{\circ}$  F. and bring the silk into the sodium peroxide bath. For the latter use an enameled vessel, copper being unsuitable for the purpose, provided with a second perforated bottom. The vessel should be of suitable size, as the silk must not be pressed together, and should have plenty of room. Dissolve in 10 quarts of cold distilled or condensed water  $3\frac{1}{2}$  ozs. of epsom salt, add carefully and slowly, stirring constantly, about 1 oz. sodium peroxide, and finally, also slowly, about  $1\frac{1}{3}$  ozs. sulphuric acid. After adding the sulphuric acid, the bath should be only slightly alkaline. It is best to proceed by adding first sufficient acid to render the bath slightly acid, *i. e.*, that blue litmus paper is just colored red; then again enough sodium peroxide for the bath to show a slight alkaline reaction, *i. e.*, that red litmus paper is just colored blue. When the silk has been placed in the slightly alkaline bath, the latter is in the course of an

hour heated to between  $176^{\circ}$  and  $212^{\circ}$  F., which is best effected by means of steam or a gas or petroleum flame. Steam can only be recommended when it can be indirectly introduced. Direct firing with coal or wood is not suitable because heating cannot be properly regulated. Allow the silk to remain three to four hours in the bath at  $176^{\circ}$  F., handling it occasionally and taking care that it is always covered by the bleaching bath. The silk when taken from the bleaching bath is passed through a lukewarm bath slightly soured with acetic acid, and to which, if required, a trace of a blue coloring matter has been added. After bluing, pass the goods, according to requirement, through a weaker or stronger gelatine bath, to which some acetic acid has been added, extract, and finish at once. It may happen that the bleaching bath has been somewhat too alkaline. In this case it bleaches more rapidly and better, but the silk loses its luster. To restore the luster rinse the goods very thoroughly after the souring, then bring them into a well-lathering castile soap bath, boil for 15 minutes, rinse three times in water of  $86^{\circ}$  to  $100^{\circ}$  F., brighten with acetic acid, and blue.

For silk articles the sodium peroxide bath may be somewhat more concentrated than for woollens. After bleaching, pass the articles through a water bath, then through a bath consisting of alcohol and a small quantity of glycerin, and dry at a low temperature up to  $77^{\circ}$  F.

The use of sodium peroxide is of special advantage when sufficient bleaching cannot be effected with

sulphurous acid. For bleaching articles which have turned very yellow, the two processes may be combined.

For garments with wool, silk and cotton, the following composition of a bleaching bath may be recommended: Dissolve for every 100 quarts of cold water, 3 lbs. epsom salt, 6 ozs. sulphuric acid, and add, with constant stirring, 1 lb. sodium peroxide.

*Bleaching of jute.* For this purpose the following method has been recommended: Bring the jute into a sulphuric acid bath of the usual strength, then rinse thoroughly and bleach by means of chloride of lime. For bleaching several chloride baths of different strengths are used, commencing with the strongest bath and reducing the degrees of chloride of lime solution from bath to bath until the jute is white. On the other hand, it is asserted that jute yarn does not become white by bleaching with chloride of lime, but at the best only acquires a reddish cream color. For this reason bleaching with potassium permanganate is recommended. The jute fiber is in this case cleaned with soda or water-glass at a temperature of 148° to 158° F.; it is then passed through a bath of potassium permanganate, and the bistre of manganese is finally detached by means of sulphurous acid. Jute is very sensitive, and should, for the purpose of cleaning, be only treated with gently acting alkaline agents or very weak alkaline lyes.

The following method may also be recommended: Soak the jute for 2 hours in a bath containing  $\frac{3}{4}$  oz. of water-glass per gallon of water, maintaining the bath at a temperature of 140° F.; then rinse, and

bleach at 86° F. in alkaline sodium chloride solution which contains about 1 per cent. of chlorine. When taken from the latter bath, rinse thoroughly, sour in a cold hydrochloric acid bath at 1-4 to 1-3 Bé., add a small quantity of sulphurous acid, and after half an hour rinse thoroughly.

*Electric bleaching.* By electric bleaching is understood bleaching with a substitute for bleaching powder, prepared by an electric process, but used in the same way as the ordinary preparation. The use of ordinary bleaching powder is connected with many drawbacks, and to overcome these, attempts were made to replace this substance by some other bleaching agent. These attempts resulted in the production of an *electrolytic bleaching* liquor, analogous in composition to bleaching powder, except that complete soluble sodium compounds were present in place of the lime compounds that always left an insoluble residue.

The most important constituent of bleaching powder is calcium hypochlorite, and in addition the compounds  $\text{Cl}-\text{Ca}-\text{OCl}$ , calcium hydroxide and calcium chloride are present. The electrolytic bleaching liquor which represents a perfectly clear fluid, contains, on the other hand, sodium hypochlorite,  $\text{NaOCl}$ . In dissolving bleaching powder a residue is obtained, and the bleaching liquor produced always shows, even after careful settlement in the air, turbidity due to particles of lime. Bleaching liquor made by the electrolysis of sodium chloride (common salt,  $\text{NaCl}$ ) does not show this defect, as it does not contain lime. Various forms of apparatus have been devised for the electrolysis



of salt solutions. Figs. 11 and 12 show Haas and Oettel's apparatus, specially designed for cleaning establishments and laundries, which appears to be the most satisfactory and most extensively employed.

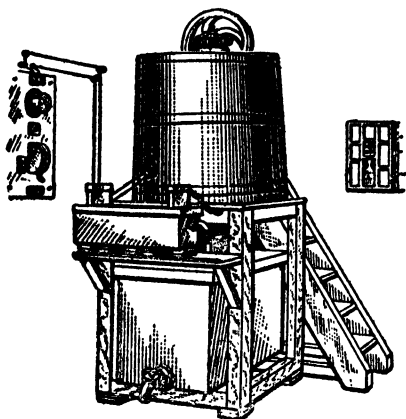


Fig. 11.—Electric Bleaching Apparatus.

With 110 volts continuous current taken direct off an electric lighting circuit, and with the use of about 55 lbs. of salt, the liquor for bleaching about 11,000 lbs. of dry weight of wash can be prepared without the employment of expensive pumps and without cooling contrivance.

The apparatus, Fig. 11, consists of a well-pitched wooden vat for dissolving the salt. The vat is provided with a stirring apparatus and tap for discharging the salt solution or brine into the cell. The cell of the electrolyser, Fig. 12, is a stoneware vat, in which the brine is subjected to the action of the elec-

tric current between electrodes of a graphitoid material which is much cheaper than platinum, but, nevertheless, more resistant. The chief aim is to prepare from the brine a clear and powerful bleaching liquor consisting chiefly of sodium hypochlorite.

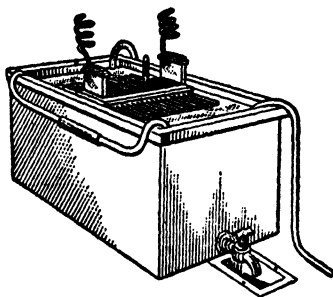


Fig. 12.—Electrolyser.

Working ten hours daily the electrodes require renewing only once in  $1\frac{1}{2}$  years. The connecting contacts are made of a non-oxidizing metal and the discharge-taps and bottom-valves of the vessels, of stoneware, so that all portions of the apparatus are at the utmost protected from the action of chlorine.

For the preparation of the salt solution or brine about half a pound of salt (rock salt) to each gallon of water is dissolved by stirring. The solution is allowed to settle for about one hour, when it is drawn off and passed through the electrolyser at the rate of from 10 to 13 gallons per hour. The clear bleaching liquor thus produced contains about 3 grammes of free chlorine per quart and is drawn off into a collecting tank of stoneware.

*Wet cleaning light-colored wool and silk articles.* Cream-colored, rose-colored, and pale blue articles are carefully washed with soap. The first two colors are carefully brightened by re-dyeing, while the latter color is revived by means of a sulphuric acid bath. Articles with dark colors are washed with quillaia decoction with the addition of a small quantity of acetic acid, rinsed, and passed through a bath strongly soured with acetic acid. This, of course, applies only to smaller articles. The use of soap bark is not recommended for delicately colored silk articles. In most cases it will be found advisable to first dry clean articles of this nature. If any stains and soil remain the articles should then be brushed with cold water to which common salt has been added. If they are badly soiled they may be brushed with a cold Tetrapole solution, rinsed in lukewarm water and soured in a cold acetic acid bath.

*Woolen undergarments* are washed in a lukewarm soap bath and rinsed in lukewarm water. When washing in the machine add some ammonia to the soap bath. Rinse in two or three waters and immediately extract. When taken from the extractor draw them smooth and stretch them gently in every direction before drying.

Flannel undershirts, etc., may also be soaked in lukewarm water, then washed in lukewarm soap suds, rinsed, and dried; or wash them in milk-warm suds of soft soap, extract, and dry. Flannels thus treated are said to remain soft, and do not shrink.

*White cloth caps and felt hats* are best wet cleaned by

brushing them with a neutral soap solution and sponging off with clear water.

*White woolen, knit or woven articles, such as sweaters, etc.,* are wet cleaned in a neutral soap solution containing borax, and rinsed in dilute ammonia.

*White silk handkerchiefs* are washed in a lukewarm bath of castile soap until sufficiently clean; they are then rinsed in lukewarm water, blued, squeezed out and wrapped in linen cloths in which they remain until sufficiently dry to allow of being ironed. The soap bath should be neutral and lather well; some ammonia may also be added.

*White silk stockings* are washed in a warm soap bath and rinsed in fresh water; if necessary, they may be sulphured and blued. An excellent plan is to dry them, if possible, upon forms and, while still moist, smooth them with a glass polisher.

*Colored silk cloths* are best washed with decoction of quillaia bark instead of soap.

*Wet cleaning silk gloves.* Wash the gloves in a bath of white soap at 122° F. and, if necessary, repeat the cleaning in a fresh soap bath; then rinse carefully, first in warm water, and then in several cold waters. An addition of alcohol is also recommended. After cleaning, dry the gloves as much as possible by pressing between linen cloths, apply a dressing of fish-glue solution, iron, and brush in the direction of the threads to impart luster.

*Colored silk gloves* are cleaned with benzine, since by this treatment the colors run least. Cleaning with soap should be done as quickly as possible to

prevent the colors from being too strongly attacked by the soap. Rinse carefully in acidulated waters and remove the water as quickly as possible by pressing the gloves between cloths.

*Cleaning fine-colored embroideries.* Fine silk embroideries and all other kinds which will not stand wet cleaning, have to be chemically cleaned. Those which can be wet cleaned are carefully washed in a solution of castile soap. Coffee and other stains, if present, are carefully removed with *eau de Javelle*. It should, however, be borne in mind that by the action of chloride of lime a red color may acquire a dull tone, and silk embroideries or fine lace insertions in a cover may also suffer thereby; hence the greatest care should be exercised. White silk, as is well known, turns yellow by the action of chlorine. Finally rinse in cold water, pass the articles through an acetic acid bath, and dry between linen cloths. A small quantity of turpentine may also be added to the soap bath. To prevent the colors from running, quick work is imperative. Should, in washing colored embroideries, the colors bleed very much and stain the white portion, the trouble may possibly be removed by passing the article through lukewarm water to which a little *eau de Javelle* has been added. Should, however, the stains not disappear by this treatment, the article should, without being previously rinsed, be bleached by exposure to the air. Afterwards it is rinsed, soured, wrapped in a cloth, extracted, and ironed while wet.

*Eau de Javelle* is prepared as follows: Stir 2 lbs. of dry chloride of lime in an earthenware vessel with

water to a thick paste; dissolve 4 lbs. of crystallized soda in 10 quarts of water, and slowly add this solution, stirring constantly, to the chloride of lime paste. Allow the mixture to settle and use the clear supernatant fluid. It should be well corked and kept in a dark place. Another formula is as follows: To a solution of 1 lb. of chloride of lime add 1 lb. of ammonia-soda, allow to settle and use the clear supernatant fluid.

When colored wool and silk embroideries are to be wet cleaned, the chief care is that the colors do not run. For this purpose prepare a solution of about 1 part by weight of castile soap for every 500 parts by weight of water. The use of a soap too alkaline, as well as an addition of soda, is to be carefully avoided. With this soap solution moisten a sufficient quantity of bran so that the entire mass is moist, but not wet enough to drip. Place the bran about  $\frac{1}{3}$  inch deep upon the embroidery spread out on a table, allow it to remain for about 10 minutes, then remove it, and rub any remaining soiled places with dry bran. If necessary, repeat the operation. Should the colors have become dull, they may be revived by moistening a fresh supply of bran with oxalic acid solution— $\frac{1}{3}$  oz. of acid in 1 quart of water—and apply as before. After removing the bran the articles should not be dried at too high a temperature, but should be freed from moisture by placing them between cloths. They are finally treated with a soft brush.

The washing of small table covers with colored embroidery often causes the cleaner much trouble, especially when the colors have already run. The

best way to proceed is as follows: Place the article smoothly upon the table and scrub both sides with cold soap suds; rinse quickly, draw through a weak sulphuric acid bath, rinse again, roll up between two clean and dry white linen cloths, and extract. Should the colors of the embroidery be very delicate, the extractor should first be set in motion and the article, rolled in the cloths, thrown in while the machine is running. Ladies' silk shawls and scarfs should be treated in the same manner. When the colors have already run, previous to washing, handle the articles in hot soap suds—without allowing them to stand—until the color stains are extracted. Should this not produce the desired effect, add a small quantity of chlorine to the soap suds, rinse, sour, and extract as above; the colors will be revived by the acid.

Should there be ladies' scarfs with variegated colors among the pieces, it is best to place them immediately upon leaving the extractor in starch powder or talcum, and brush them when dry.

A large German establishment, where many dozens of antimacassars, cushion-covers, etc., are received and washed every week, has adopted the following plan for cleaning colored embroideries on a white or light-colored fabric. These embroideries, which are usually executed in silk or mercerized cotton, are often received in a very dirty condition and stained with grease, wine, coffee, etc.

The goods are first dry cleaned to remove grease. The benzine affects very few colors, there being only a few reds which are soluble in that liquid. These

are recognized by a preliminary test, and goods containing them must be treated by themselves.

When the goods cleaned with benzine are nearly dry they are sorted into various grades of dirtiness. Two soap baths are then prepared of neutral grain soap, one warm, the other cold, and both lathering well. The goods are first soaked in the cold soap bath, and then spread out on a board without wringing, and brushed over with some of the warm soap bath. The goods are then passed through a clean warm soap bath and rinsed three times, twice with warm, and finally with cold, water. A passage through cold weak acetic acid is then given to liven the colors, and the goods are dried.

If any bleeding takes place during the brushing, transfer to the clean warm soap bath as quickly as possible, handle briskly in it for a few minutes, rinse thoroughly but with all expedition, and dry immediately after the acetic acid bath. If the warm soap bath will not remove the color which has bled on to the ground, a boiling bath must be tried, but it must be very weak and its action should not be unduly prolonged. If this treatment also fails, try a very weak bath of chloride of lime, pour in very dilute sulphuric acid, rinse thoroughly, liven, and dry. Much depends upon speed, and if these various processes have to be gone through in succession, the need of the most rapid working is all the more urgent. Bleaching powder must, however, not be used with silk embroideries, as it turns them yellow.

If there are any stains left in the washed goods



they will probably be due to the dye or to iron. These are removed by local treatment, the one sort with chloride of lime, the other with oxalic acid. The stain is dabbed with the solution and the place is carefully freed from it after the stain has disappeared by repeated applications of clean water. Care must be taken that the solutions are not too strong, and particularly that the bleaching solution contains no undissolved particles, as they will cause holes.

Special care is required in extracting the goods before drying. A clean woolen cloth is laid out and the embroidered articles are spread on it and rolled up in it, but in such a way that the colored and white parts of the articles are not in contact. The roll is then extracted just as it is. When the roll has been in the machine ten or twelve minutes, it is undone, and the embroidered articles are dried.

Many dyes bleed the moment they are wetted, others only after a rather long washing with soap. The surest safeguards against bleeding are the use of moderate temperatures and the entrusting of the work to a skilled and dexterous hand who will do the cleaning with the utmost expedition. In many cases the addition of a little acetic acid or common salt to the soap bath is a great help, especially for goods that are not too dirty. Quillaia decoction with a few drops of turpentine often answers better than soap. If the embroidery has a lining which has been dyed with a dye which is not fast, nothing can be done but to remove the lining and wash it separately. It may also be noted that the colors most likely to bleed are olives,

certain greens and yellows, and also dark red, violet, Bordeaux, and orange.

*Washing laces, blonde-laces, embroideries on linen.* White imitation (cotton) laces, as well as embroideries on linen, are cleaned in lukewarm soap suds, bleached, and blued as given below under curtain washing. Either pin the lace, while wet, to a cushion, or iron it, care being taken not to get the design out of shape. Laces and curtains should not be rubbed or boiled too long.

Real laces and silk blonde-laces with very delicate designs should be dry cleaned, any remaining stains being removed by local treatment. If such articles have to be wet cleaned proceed as follows: Fold the lace carefully and fasten with a few stitches along the edge. Next place it in a little bag made of fine old linen, which should then be sewed up. Place this in a vessel of pure olive oil, and soak for 24 hours. The next day boil one-quarter of an hour in soap suds made by dissolving the soap in soft water. Rinse in cold water without squeezing the lace, until the water remains clear; then pass it through thin, slightly blue starch water; take out of the bag; press slightly between the fingers, and iron with a hot iron.

Since real laces, in order to preserve them, are very rarely washed, they are apt to be rather rotten and very yellow. If they have ever been wrongly treated they are harder to clean than others. By soaking them in olive oil as recommended above, the thread which has become rotten and thin from age or from washing, is restored to its former elasticity.

Another method is as follows: Wind the lace smoothly and tightly about a wide bottle previously covered with old white linen or similar material. Tack each end of the lace with a needle and thread to keep it smooth, and be careful in wrapping not to crumple or fold in any of the scallops or pearlins. After the lace is on the bottle soak it thoroughly to the inmost folds with olive oil by means of a clean sponge. Have ready in a kettle a strong cold lather of soft water and castile soap. Fill the bottle with cold water to prevent its bursting during boiling, cork well, and place it upright in the suds, with a string round the neck secured to the ears or handle of the kettle, to prevent its knocking about and breaking while over the fire. Let it boil in the suds for an hour or more till the lace is clean. Then dry on the bottle in the sun. When dry take the lace from the bottle and wind it around a wide ribbon spool; or lay it in long folds, place it within a sheet of smooth white paper and press it for a few days in a large book.

Instead of a bottle a round piece of hard wood about 10 inches long and 4 inches in diameter may be used. The wood with the lace wound about it, and the whole covered with a white linen cloth, is worked in the soap bath between the hands till the lace is clean.

A perforated cylinder of white porcelain, Fig. 13, may also be preferably employed in place of a bottle. Cover the cylinder with fine muslin, wrap the lace about the cylinder and cover the whole with muslin. Boil in soap suds, rinse in cold water, starch and dry, the latter being quickly effected in consequence of the

many perforations of the cylinder. When dry remove the lace from the cylinder.

*Cleaning white curtains.* Most of the dirt and soil contained on curtains is held there by the starch contained on them. Therefore, the first step in cleaning these articles should be to remove the starch. This

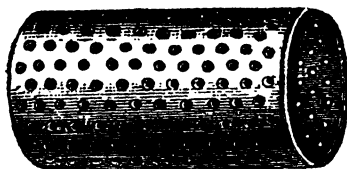


Fig. 13.

may be done by using a malt extract bath, 4 pounds of extract to 100 quarts of water, at a temperature of  $120^{\circ}$ , and soaking the curtains in it for several hours. The malt extract converts the starch to sugar, which is easily washed from the material along with most of the dirt. After the starch has been removed the curtains should be washed in a hot, fatty soap and soda bath, and then placed in a bath containing soap and soda and a small amount of perborate. This bath is slowly brought to a boil and the curtains boiled for ten minutes, at the end of which time they should be removed and rinsed. Next treat the curtains for 10 minutes in a weak sulphuric acid bath with ultramarine. Then starch with boiled wheat starch, adding some talcum to the latter to give the curtains the appearance of newness. Stir the talcum into the cold starch, and boil, but only for a short time, as by too

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long boiling the starch loses its adhesive power. Pass the curtains as hot as possible through the diluted starch, squeeze well, and put them in the curtain stretcher.

*Cream-colored curtains* are treated exactly as above, except that Burmol is used in place of perborate. The Burmol strips the old faded color and an even retinting must then be done. For tinting a cream color use a small amount of Diamine Yellow. There are a number of ecru shades on the market, but if one prefers he can make his own mixture by using a small amount of yellow shaded with blue and red. One part yellow,  $\frac{1}{6}$  part of blue, and  $\frac{1}{6}$  part of red makes a good shade.

Cream-colored curtains, which have been dyed with dye-woods or catechu, are recognized after washing by their gray or brownish color. Their original color is restored by passing them through a bath to which a few drops of hydrochloric acid have been added; subsequent thorough rinsing is absolutely necessary, otherwise the threads would be burnt by the acid.

To curtains that have a gray dirty tone, a brighter color may be imparted by passing them through a warm bath containing diamine yellow with the addition of Auramine II. The color of curtains may also be revived in a cold-water bath to which a few drops of nitrate of iron have been added.

Curtains which will stand washing in the machine should be put in a coarse net unless the attendant knows his business thoroughly, when they may be put in loose. In any case run them a few minutes with cold water or very weak soda. After drawing

off this water, run them in strong soap suds with a little soda, taking care there is plenty of liquor to prevent the curtains from being torn. Begin cold and warm up, and after about ten to fifteen minutes draw off the lye and replace it with fresh. Next boil the curtains. Then rinse, first warm and then cold; blue in the machine, extract, and finish with wheat or potato starch. Finally dry on a stretching frame.

*Washing colored curtains.* When curtains interwoven with colored yarn are to be cleaned they should be examined as to whether the colors have already bled on to the white ground. Colored curtains should be tested as to the action of soap on them. If the colors are very fugitive, the curtains are washed by hand as quickly as possible in a cold soap bath made with as neutral a soap as can be got. Care must be had to keep different colored articles separate. If the dyes are fast the machine can be used. First rinse the curtains for a few minutes in cold water, then run them successively in two lukewarm—rather cold than warm—soap baths, rinse and add to the last rinsing water some acetic acid to liven the colors. The machine should not be stopped during the changes in the liquors, to prevent colored parts lying on white parts and bleeding onto them.

Red cotton curtains are brushed cold. If they contain black or dark portions, they are scoured hot in the sulphuric acid bath, rinsed, and extracted.

*Washing veils.* Different treatment is required for white and colored veils. *White veils* are washed in blood-warm soap water, gently wrung out, rinsed in

cold water, blued, starched, beaten half-dry between the hands, and finally hung up to dry thoroughly.

*Black and colored veils* are cleaned by rinsing in soda and water to remove the dirt; then in pure water to remove the soda, and finally in a little gum-water to stiffen and crisp them. They are clapped half-dry between the hands, and finally hung up to dry thoroughly.

*Mourning veils and crapes* of the better quality should be cleaned with benzine, as they will not stand soap. After cleaning they are dressed with a size prepared according to one of the following formulæ. Both sizes make the fabric practically waterproof.

1. Dissolve 4 ozs. of beeswax in about 3 quarts of benzine on the water bath, cool, and make up to 4 gallons with benzine.

2. Use a solution of 4 ozs. each of bleached shellac and beeswax in 5 quarts of methyl alcohol. Dissolve first the ingredients in a small quantity of the solvent and subsequently dilute with the remainder. This size gives a stiffer dressing

*Washing silk and silver laces.* Place the laces in curdled milk for 24 hours. Stir a piece of good soap reduced to shavings, in 2 quarts of soft water, add a proportionate quantity of honey and fresh oxgall, and beat the whole for some time. If it becomes too thick, add water so that a thin paste is formed. Allow this to stand for 12 hours and then apply it to the wet laces. Then wrap a moist cloth around a mangle roller, around the cloth the laces, and around the latter another moist cloth. The laces are then mangled,

they being occasionally moistened with water, and several times brushed over with the above-mentioned paste. Next soak gum arabic in water until completely dissolved, add an equal quantity of sugar, and when this is completely dissolved, and the solution has become clear, immerse the laces in it; then mangle them smooth between two cloths, and hang them up to dry.

*Washing gold laces.* Place them over night in a weak solution of acetic acid and then proceed in the same manner as with silver laces.

If the laces, etc., are worn so that the white ground shows through, they may be restored as follows: Extract 50 parts by weight of shellac, 2 of dragon's blood, and 2 of tumeric root with strong alcohol, and decant the ruby-red extract. Apply the extract with a camel's-hair brush to the articles to be restored, and then pass over them at the height of several inches a hot flat-iron, so that the laces are only exposed to the heat without coming in actual contact with the iron.

*Cleaning gold and silver galloons.* If these have been ripped off and are not too dirty, they may be washed with rectified turpentine. They may also be soaked for some hours in water to which acetic acid has been added, and finally brushed with soap solution by means of a soft brush. For cleaning gold embroideries on a dark ground, rouge is recommended. For gold and silver embroideries on a light ground use very fine whiting or Vienna lime, and gently and carefully rub the embroidery with a soft brush dipped



into the dry powder, so that nothing drops upon the fabric beneath.

An excellent plan for cleaning gold and silver galloons, embroideries, fringes, etc., is as follows: Dip a small pad of cotton in pulverized tartar and rub the articles till they are bright, taking care not to soil the fabric beneath.

*Cleaning parasols.* The cleaning of parasols on the frame presents many difficulties, but is apt to be a remunerative branch of the cleaner's business, especially during the spring and summer months. On receiving such articles they should be carefully examined as to their fitness for cleaning, as they are frequently worn in the creases and damaged on top. Such parasols can only be cleaned with benzine; they would not stand wet washing, as they would immediately split. It is, therefore, best not to undertake them at all.

White silk and cotton parasols are best cleaned on the frame by washing in cold soap suds and scrubbing the crease streaks with a soft brush. Care must be taken not to damage the fabric, and if there are doubts as to its condition, a sponge should be used instead of a brush. Next rinse the parasol in warm water, then pour over it a dilute solution of sulphuric or saccharic acid, and rinse again in clean water to remove every trace of acid from both the goods and frame. The parasol, while open, is now rubbed off with a piece of chamois, and pieces of white paper are inserted between the metal parts and the goods; it is then whirled a couple of minutes in warm air and then allowed to

dry while still raised. White cotton parasols should be treated with warm *eau de Javelle* instead of saccharic acid. The handle should, if in any way possible, be kept dry, otherwise the color and lacquer are likely to suffer.

Colored and checkered parasols are cleaned in the same manner, but black checkered covers should not be treated with acid, common salt being substituted to keep the color from running. Embroidered parasols are also washed in the same manner; should the colors of the embroidery run, pass the parasol through warm soap suds, rinse immediately, dry quickly with a piece of chamois, and cover the embroidered parts with plaster of Paris, which will rapidly absorb the remaining water and thus prevent the colors from running. Finally dry the parasol quickly in the sun or by artificial heat.

In wet cleaning parasols it will be necessary to see whether the joints are lined with leather or colored silk; if this be the case the utmost dispatch in treating the parasols is imperative. Light-colored parasols should be cleaned with soap, dark ones with quillaia and ammonia. Those that are lined as mentioned above should be wrapped in a clean cloth, white paper inserted under the ribs, again well rubbed and quickly dried. A weak gelatine dressing will also be necessary. Parasols with wooden handles must not remain long in the wash liquor, as otherwise the wood might swell. The parasols should also be frequently turned while drying.

Dark parasols are cleaned with benzine, and when

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the latter has evaporated, brushed with quillaia bark decoction and dried as previously described. Souring with dilute acetic acid is very beneficial to the colors, but a good sponging and dressing with gelatine solution mixed with alcohol will also answer. Parasols treated in this manner look like new.

As the parasols are dried while raised, ironing will not be required. Trimmings of ruffles, plaits, or lace, must, however, be ironed. Ornaments, such as beads, or cords, should be removed before cleaning and treated separately. Rust spots are removed with hot saccharic acid or some similar stain-removing agent.

Very fine parasols which are only slightly soiled should only be cleaned with benzine, and when the latter has evaporated, brushed with distilled water and alcohol. In all cases when parasols are being cleaned the cleaning and drying processes should be expedited as much as possible. If too much time is taken there is danger that rust from the frame will collect on the fabric.

*Dark colored silk plush.* The material may be wet cleaned by brushing with clear water without the use of any soap. After cleaning, the luster must be restored. This may be done by sponging the garment with a solution made in the following proportions: 1 pint of benzine, 1 pint of ether,  $\frac{1}{2}$  pint of rectified alcohol. Moisten a dark-colored rag and go over the fabric, rubbing in one direction only. After drying, the garment is finished by steaming.

*Georgette crêpe.* Clean in lukewarm water to which a small amount of soap has been added. If the water

is too hot, or if too much soap is used, yellowing will take place in the case of white and delicately colored articles. After cleaning, the goods should be soured in a weak acetic acid bath.

*Khaki kool.* This is a fabric made of wild silk, and will clean satisfactorily when handled in the same manner as tussak silk. After being cleaned and rinsed the material should be soured with acetic acid.

*Rubberized garments* such as raincoats must be wet cleaned, using cold water. Some soda and ammonia should be added to the water, or soap bark used. After rinsing, the garments should be allowed to dry in a cool place, never in a hot, dry room.

*Cotton velvets, corduroys, etc.,* are first soaked in a weak lukewarm soda bath and then scoured with a good soap solution. They should then be worked in a soap bath, and rinsed twice in warm water. If the material is white the color may be improved by bleaching after cleaning. After bleaching they should be well rinsed, extracted, brushed on a steam board and dried. Dark-colored articles of this material are best cleaned with soap bark or with cold Tetrapole solution.

*Palm Beach clothing.* The original Palm Beach cloth is a mixture of linen and wool, but as it is now made it may or may not contain any wool fiber; in fact, the very large majority of the men's and women's suits known by this name contain little if any wool, cotton being substituted in its place. The fabric is rather heavily sized with starch, and on account of this fact an exclusive dry-cleaning process will not produce satisfactory results, as benzine does not dissolve starch.

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Therefore, in the large majority of plants, Palm Beach clothing, especially that containing wool, is wet cleaned or is cleaned by both the wet and the dry process, the former method being used first. When the fabric is made up of cotton and linen and contains no wool, the wet-cleaning process is sufficient.

The dry cleaning should be done with the addition of soap and ammonia to the benzine. Preferably the ammonia should be added to the soap before the latter is placed in the benzine in the washing machine. After the clothing has been dry cleaned it is rinsed and extracted, after which it is ready for the wet cleaning. Palm Beach clothing that has been dry cleaned need not be dried before being wet cleaned.

The wet cleaning is done in the ordinary manner with the addition of soap, soda or ammonia to the wash water. The cleaning should be hurried as much as is consistent with good work in order that as much as possible of the original sizing will remain in the goods. An excellent method of cleaning is to lay the garments on a wash board and scrub them with a brush dipped in the wash water. A good lathering soap of good quality should be used and the water should be cold when the cleaning is started. As the work progresses the water may be brought to a hand heat. Only cold water to which salt has been added should be used for rinsing. Extracting after rinsing is not necessary. If possible, the cleaned garments should be dried in an airy, sunny place. If the work is properly done the garments will not shrink nor will they lose their fresh, new appearance.

If possible, the cleaner should refrain from cleaning Palm Beach garments on wet, rainy days, as it is almost impossible to keep them from becoming sticky when the work is done at these times. If the work must be done, the garments should be extracted after cleaning and finished while they are still damp with a hot hand-iron.

Many stains, including those caused by rust and ink, are very difficult to remove from tan and ecru-colored Palm Beach garments. These colors are produced on the fabric either with a nitrate of iron or with sumac, both of which are destroyed by mineral acids, the reagents most frequently used for removing rust and ink stains. If boiling water, or a hot solution of soap and ammonia will not remove the stains, no further attempt should be made to eradicate them, otherwise a white spot is very sure to be left.

*White linen garments* are cleaned in the same manner as those of Palm Beach, except that they should be bleached after the cleaning process is completed. The bleaching may be done with chloride of lime, working them for thirty minutes in the cold bleach liquor. They then should be rinsed and placed in a bath containing 2 pounds of hypo and 2 pounds of acetic acid to each 50 gallons of water. Oxalic or sulphuric acid may be used in place of the hypo, in which case 1 pound of the particular acid should be used to each 50 gallons of water. When taken from this last bath the goods should be rinsed and blued.

*Wet cleaning carpets.* Very dirty carpets, especially those about which there is no doubt as to the fastness of their colors, are wet cleaned. The first thing to be

done is to free the carpet from dust, either by beating by hand, in a wheel, or by a beater. A dusting in a wheel, followed by a strong vacuum, has been found to give excellent results. This preliminary must on no account be neglected if the carpet is to look any better after cleaning than before.

It is advisable to test the fastness of the dyes in the carpets to be wet washed with a cold neutral soap solution. The best way to do this is to let the solution act for a few minutes on a corner of the carpet. The solution should be strong enough to lather well. After the solution has acted for a sufficient length of time, rinse well, moisten with dilute vinegar, and dry by pressure between cloths. The subsequent operations must be regulated according to the appearance now presented by the corner of the carpet.

The best method of procedure is as follows: The carpet having been spread out on a clean floor, wrong side uppermost, it is brushed over thoroughly with plenty of clean cold water. It is then turned over and the brushing is repeated. A squeegee can be used to get rid of the dirty water, and the floor should be of concrete and provided with drains. The next step is to brush by hand or machine with a good lathering neutral soap, using more and more soap, until the froth stands unchanged upon the carpet. Removing the soap with a squeegee and rinsing with plenty of clean water comes next, whereupon the colors are brightened with dilute acetic acid, and the carpet is hung up to drain or extracted if a big extractor is available. If ordinary soap is not used there is little fear of the colors run-

ning. Either ammonia or carbonate of soda will accelerate the cleansing process, but at the imminent risk of making the dyes bleed, and so spoiling the appearance of the carpet.

Let us now suppose the cleaner has to deal with a carpet which has suffered by a previous unskilled washing in which common soap has been used. The run colors cannot be put back into their proper places, but much may be done in the way of removing dye which has reached places for which it was not intended, and it often happens that the proper places still retain enough coloring matter to enable the cleaned carpet to be quite, or nearly, as well colored as it was at first. In such a case we begin by soaking the carpet in plenty of warm water. This will take out some, perhaps nearly all, of the strayed coloring matter. After lifting, the carpet is spread out on the floor and washed as above described, but with a perfectly neutral soap. Here the cleaner has an opportunity of showing his skill. Not only must the soap be perfectly neutral, but not one ounce of it more than is absolutely necessary may be used, and although the lye must probably be used hot, or at least warm, the cooler it is the better. The rinsing is done in very weak carbonate of soda. The carpet is finally scoured and extracted. In the latter process the carpet must be rolled up in a clean cloth, so that should there be subsequent bleeding the cloth protects the rest of the carpet. If any sizing is needed, strong glue is best. Weak glue will again provoke the main danger of carpet cleaning—the running of the colors.



A machine is now on the market that automatically dusts, scrubs and rinses a rug, the three operations requiring but about four minutes for a 9 x 12 rug. However, the machine necessarily is an expensive one and it can be used profitably only in those cleaning plants that do a very large volume of carpet-cleaning work.

## IV.

### FINISHING CLEANED FABRICS.

THE object of finishing is to give the cleaned or dyed articles the required feel, luster, shape, and a good appearance in general. This operation includes starching, gumming, steaming, ironing, pressing, stretching, dyeing, etc. Everything depends on a good finish, so that the greatest attention has to be paid to the operation. No matter how carefully an article may have been cleaned, it presents a poor appearance if the required finish is wanting, while, on the other hand, any defects which could not be removed are more readily overlooked if the article is well finished.

The cleaning operations leave the articles with more or less of the solvent or the water, and this has to be got rid of by extracting or wringing. With small lots this may be done by hand or with the familiar wringer, which may be applied to nearly all fabrics, with the exception of velvet, velveteen, plush, and all fabrics having a pile. The main thing in wringing is to fold the articles the right way so that when the wringer is used they are drawn into the machine in the direction of their length.

The best means of removing the water from wet

textile fabrics is, however, by the use of an extractor, similar to that described under dry cleaning. In some cases, when the goods are removed from the extractor, they will be found sufficiently dry for all the finishing operations.

For the quick drying of wet cleaned or dry cleaned articles the drying tumbler is to be preferred. When this machine is used there is a constantly changing wet surface, and hence quicker drying, which is very necessary in this work.

Garments liable to shrinkage are best dried stretched on frames, at a low temperature, or, in the case of some ladies' garments, on cones. As regards linings, the modern practice is to dampen them with water when the rest of the garment is dry, and then use hot steam pipes. This is the best way of preventing the occurrence of shiny places in the lining. The work is also done more quickly, so that with only one or two sets of apparatus a large quantity of goods can be quickly handled and the turnover of the establishment increased. For sprinkling dressings on linings, ordinary sprayers with various sized orifices answer well. A set of finer and coarser sprayers can be provided at a very small cost. They come in useful also for spotting, damping goods for ironing, and even in some cases for dyeing.

For shaping and smoothing, steaming tables and steam presses are necessary. A small business would require a steaming table with a steam cavity about 32 inches long and tapering in width from 16 to about 6 inches. This should be supplemented by a cylin-

dricul steamer about 8 inches long and  $3\frac{1}{2}$  inches in diameter. The larger steamer should stand freely on the floor or on a cast-iron sheet, as then long and wide articles, such as carpets, can be conveniently steamed on it. A medium business requires from four to six steamers, two cylindrical, one large and one small, the others of plate and spherical form. The larger cylindrical steamer should be about 2 ft. long and 6 inches in diameter. The steam must have a pressure of at least three atmospheres; more may be wanted. For pressures of five atmospheres and upwards and for large steamers, brass or cast iron is the best material, but for lower pressures copper should always be used as it combines good conductivity with small radiating power.

Many articles of wearing apparel are finished by hand-ironing on ordinary ironing tables or skirt boards, covered with one or more layers of gray felt and a layer of white muslin. The irons used may be heated on a stove, by the internal combustion of gas or denatured alcohol, or by electricity.

*Finishing white and colored woollen shawls, fichus, etc.* Open-meshed crocheted and woven shawls are passed through the extractor, and while still moist are stretched to their original size and shape and allowed to dry at a low temperature. Square shawls may be loosely stretched in a frame.

Long shawls and all closely woven fabrics are steamed and partially lightly pressed, but generally cold. Blankets are held in shape while drying and when dry are carded to raise the nap.

*Finishing white and colored silk shawls, etc.* White and colored articles are finished with dilute starch or pure gelatine. The gelatine liquor must not redden blue litmus paper, since when the blue (ultramarine) is added, the latter by the action of the acid turns gray, and a pure white tone cannot be obtained.

Many wet cleaned silk articles require a dressing; suitable for this purpose are: Irish moss, gum tragacanth and gelatine; the latter two for light articles. Irish moss is best for the black and dark-colored silk. To prevent black garments from becoming hard in dressing and to give them a soft feel, dressing oil is used. The previously dried articles are drawn through one of the above-mentioned dressing solutions, and the dressing preparation is applied by means of a soft brush or a soft sponge. The strength of the dressing depends on whether the article requires a hard or soft feel. A good size for silks may be made as follows: Water, two gallons; bran, one ounce. Stir and allow to settle, after which pour off the clear liquid and boil it. When it becomes thick it is ready for use. It should be used cold. Gelatine, to which some acetic acid has been added, applied to the reverse side, is also a good size.

When dressing silk it may happen that it wrinkles, this being due to the tension of the thread produced by the heat. This is the case with some silk fabrics, even when dressing them only with water. Such wrinkles are removed by pressing with a medium-warm iron between tissue paper.

*Finishing laces, embroideries, etc.* As regards finish-

ing such articles, much attention must be paid to their quality. Coarse common lace is dressed with starch, sometimes very heavily, and with a mineral filling as well. The amount of stiffness imparted is of much importance and depends a great deal upon the use to which the lace is to be put. Stiffness that would be out of place in a lace collar, for example, may be advisable in trimming.

As a general rule, the better the lace the more lightly it must be dressed. Gelatine is used for some laces and must be applied thin and not too hot. With the same precautions tragacanth does useful service. Great care must be taken that all dressing solutions are colorless and clear, or the appearance of the lace is sure to suffer, especially that of dyed lace. Some finishers use a combination of farina and a gelatine preparation from wheat gluten, or even gluten by itself, but gluten putrefies more easily than animal gelatines, and is more likely to give bad color and odor.

After dressing, all laces must be pinned out on the cushion or stretched on a steam cylinder when half dry, so that the drying can be completed without shrinkage or distortion. Fine laces may sometimes be finished by ironing, to good advantage.

For white lace the best grain soap has lately been recommended as a dressing. The soap must be of the very best, and is used in lukewarm solution mixed with just a little ammonia. To prevent any yellow tinge, the goods are blued in lukewarm water containing methyl violet and a trace of sulphuric acid. A really first-class soap gives excellent results, although

the dressing, of course, is not fast to water. It also gives a beautifully smooth and soft handle.

*Plush and similar articles* acquire a soft, velvety feel by taking them through a soap bath, followed by a steaming and a brushing.

*Black silk laces, etc.*, acquire a good luster by dressing with decoction of fleawort seed, or they are squeezed well between the hand and ironed dry.

With laces, cleaning is of secondary consideration, smoothing and glossing them, which is less effected by ironing than by stretching and steaming, being of prime importance. A steaming apparatus of copper or zinc may, according to requirement, have the form of a plate or cylinder and should be covered with baize or fine muslin. After steaming the laces, small table covers, crocheted articles, etc., are smoothly pinned to a cushion and dried.

*Dressing for white embroideries.* Treat with fat grain soap solution heated to about 95° F., to which some ammonia has been added; blue in lukewarm water with methyl violet and a little sulphuric acid. By this means the yellow tone and dull luster will disappear.

*Finishing curtains.* This has been fully referred to under "Washing Curtains." To prevent as much as possible tulle and curtains from sticking together, the use of the following starch preparation may be recommended: Stir into 60 quarts of cold water 7 to 8 quarts of clear chloride of lime solution of 7° Bé., then introduce, stirring constantly, 22 lbs. of potato flour, and bring the whole to the boiling-point. At

from 140° to 186° F. the result will be such a stiff mass that it can scarcely be stirred. When this consistency has been reached, shut off the steam, stir constantly, and in about 5 to 10 minutes the mass will be found to become thinner in consistency. Now introduce steam, and after actual boiling for about 5 minutes, the mass will become thin as water. Continue boiling for at least  $\frac{1}{4}$  hour for the volatilization of the chlorine gas. Then add one to two quarts of glycerine, and boil again for five minutes, when the dressing can be used without the addition of water.

When the curtains have been starched they are stretched while moist in a curtain-stretcher.

*Plush draperies* are thoroughly steamed after drying, and the pile is raised by brushing.

*Finishing men's garments.* Some men's garments, after drying, require steaming on a steam-board, while others do not. Men's garments that have been dried

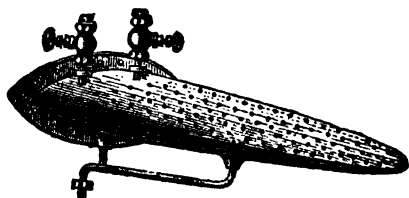


Fig. 14.

in a tumbler seldom if ever require a steaming, nor do those that are to be finished on a steam-pressing machine. The steam-board consists of a slightly arched hollow copper cylinder, the top of which is perforated with a large number of holes. It should



be so constructed that the water formed by condensation separates at the lower end, so that only dry steam passes out through the holes. The construction of such steam-boards will be readily understood from the accompanying illustrations. Fig. 14 shows a large steam-board, about 64 inches long. It consists of a front and

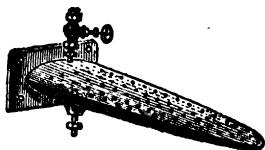


Fig. 15.

back part which can be used independently of each other. The shape is such that pantaloons may be drawn over the front portion. The arrangement for freeing the steam from water is such that it is impossible for moisture to pass into the goods. After steaming, the garments are pressed.

The steam-board shown in Fig. 15 serves for steaming the sleeves of men's coats. Fig. 16 is a steam-

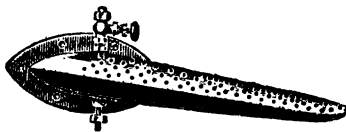


Fig. 16.

board for pantaloons, and Fig. 17 is a steam-board for coats.

Another form in which these steamers are made is that of a table with a rounded top, as shown in Fig.

18. The table is mounted upon a strong wooden frame, and serves as a substitute for the ironing cushion mentioned later on in pressing men's garments.

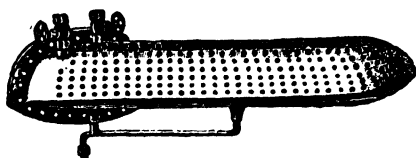


Fig. 17.

The steam is conveyed into the steamers by pipes, and there are also exit pipes for condensed steam and surplus steam. In order that dry steam may

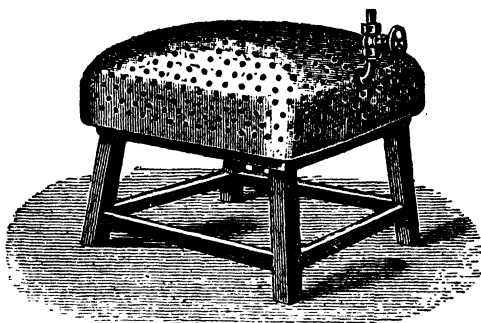


Fig. 18.

always be available and no moisture appear upon the steamer, the pipe conveying the steam into the steamer should run the entire length of the latter, the holes should lie downward, and the bottom of the steamer be so shaped that the center is the deepest part. By the holes lying downward the water forced

along with the steam is prevented from being carried upward by the steam, and by the convex shape of the bottom, the steam condensed in the steam box is impelled downward. It is also advisable to place a finely perforated cover of copper over the steam-pipe, and to see that the steam produced by the boiler is not too wet.

For pressing men's garments by hand Vollbrecht gives the following directions: Provide a solid cushion about 3 feet long, 16 to 24 inches wide and 6 to 8 inches deep. This cushion should be shaped so that it is rounded off on one side similar to a steam-board and be covered with firm linen free from dressing. For pressing serves a block of iron with a detachable handle, and this should be thoroughly heated without being red-hot. For brushing off the steam use a close, short-bristled brush, like a large clothes brush, and in addition have a strong clean piece of linen free from dressing.

Pressing is executed as follows: The portion of the garment to be pressed is laid smoothly upon the cushion. Moisten the clean linen cloth with water, and after squeezing it out, lay it on the article and run the hot iron over it until it appears dry. Then remove the cloth quickly and beat the steamed part with the brush till the steam has disappeared. Finally stretch and brush the article.

When pressing a man's coat, press the sleeves first, then the breast or front portions. Next come the lapels and collar, pressing them sharply under the linen cloth doubled. Finally press the back portions

of the skirt. The lining is then pressed, without, however, using the damp linen cloth, which finishes the coat.

Pantaloon are laid so that the crease comes closely back of the side seam. Press the front side up to the crotch, then place them so that the side seam lies upon the inner seam; press once more, but only to near the knee, so that there is a slight crease back which contributes towards a good set. The band, lining, pockets and the upper inner portion to the crotch are then pressed dry, as well as the facing, which finishes the operation.

When pressing waistcoats, the two front portions of the fabric and the collar are pressed wet, and the inside portions of the front parts dry, as well as the back, the latter being pressed on the outer right side.

In establishments where men's suits in large quantities have to be pressed, a bust-finishing machine and a flat-pressing machine are sometimes used; the former is employed for shaping and finishing the bust, shoulders, and collars of men's coats, and the latter for finishing the sleeves and flat portions of coats and pantaloons.

Heavy irons to which foot-pressure can be applied are sometimes used for pressing men's clothes. This machine is fitted with a heavy tailor's iron, the latter being heated either by steam or gas.

The slow and tedious process of pressing clothes by hand is, however, connected with many disadvantages. The extremely high temperature—approximately 900° F.—at which it is necessary to operate the hand-iron

used in connection with a damp pressing or sponging cloth, in order to simultaneously press and steam the garment, has a damaging effect upon the cloth. It robs the cloth of its oils, frequently bakes it to a crisp, destroys elasticity, softness, life and color, changes the character of the fabric, leaving it harsh and brittle, instead of soft and pliable.

Still another problem with which many have to contend is the lack of uniformity of finish, it being almost impossible to give to the entire garment an equal amount of pressure, heat and moisture. Scorching and gloss due to overheated hand-irons, careless, indifferent and inexperienced help, are of frequent occurrence and a source of annoyance and of considerable expense.

Machines for pressing clothes by steam are for the above-mentioned reasons rapidly superseding the goose or hand-iron. The machines made by the United States Hoffman Company of Syracuse, N. Y., have not only overcome the many deficiencies of the hand-iron, but also have surpassed it in the quality of the work produced and the volume of output. They accomplish three times the work, and eliminate any possibility of damage to the cloth, it being by this method impossible to scorch a garment. The steam improves the general condition of the cloth because it does the work at the right temperature—300° F. It raises the nap, prevents gloss, brings out the color, imparts new life, luster and beauty to the fabric, and gives it that flexible, soft feel heretofore so difficult to obtain. By injecting steam into the cloth, the garment

is readily shaped, instantly dried and set. Besides, the process is a sanitary one, as all steam-pressed garments are sterilized garments, the advantage of which is too obvious to require further comment.

Fig. 19 shows model "A A" of the pressing machines manufactured by the United States Hoffman



Fig. 19.

Co. It is perhaps the most popular press of the entire line by reason of its general adaptability to most classes of work. It requires a space of about 4 feet square. The frame is made extra heavy at all pressure points, so as to provide against undue strain at the hands of thoughtless operators. All piping is of wrought iron, all steam fittings of bronze. The boiler is of special construction, after the manufacturers' own specifications. It is provided with water gauge, steam gauge, pop valve regulated to hold any steam pressure desired, and pump for filling. It is guaranteed

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to stand an hydraulic pressure of 220 pounds, and in many instances tests of more than 500 pounds have been made. The working pressure, however, is very low, being only 60 pounds, and this is quickly generated and easily maintained, the quantity of gas used for the purpose being about the same as ordinarily used for heating irons.

In cases where plants have their own steam equipment, the machine is provided with a separator in place of the boiler for direct connection. Steam is piped from the boiler or separator on the machine to a steam chamber forming part of the head. The bottom of the head proper is fitted with a perforated plate through which the steam is diffused and spread onto the garment. This steam also serves to keep the head heated to the required temperature. The head is perfectly balanced, and can be easily raised and lowered. Beneath the head is the steam-heated stationary buck corresponding to an ironing-board. The garment is heated from top to bottom, or, in other words, on both sides. The head and buck are linen-covered and the latter is also properly padded.

After having obtained a pressure of 60 pounds, the machine is ready for work. The operation is extremely simple. The garment is placed on the buck, the head brought down into position upon it, and steam is passed onto the cloth by slightly opening the valve on top of the head. The head is held down upon the garment, at any desired pressure, and this pressure is maintained without effort by means of a powerful lever. Pressure is then released from the lever, and

the head returns to its original elevated position. This operation requires less time than it takes to tell about it, and is of course repeated until the entire garment is finished. It is not necessary to hang the garment up for drying, as the hot dry steam accomplishes this during the course of pressing.

*Finishing ladies' garments.* A good finish of these articles, the correct choice of the dressing medium, and smoothing are of the utmost importance. Chemically cleaned articles give the least trouble; thinner articles need only be brushed while ironing with gelatine water. All other articles require no further dressing, and by a medium hot flat-iron the shape can be readily restored.

Starch together with some gelatine is the best dressing for light-colored linen, cotton, half wool and thin wool fabrics. For dark fabrics, glue and Irish moss are used, and for silk, gum tragacanth or gelatine. The dressing should be employed in as finely divided a state as possible, which is effected by thorough soaking, long boiling, and straining.

For cotton goods a good brand of wheat starch may be used, which for light-colored and white articles is slightly blued with ultramarine. For dark blue, dark red and black cottons, as well as for wool and half-wool fabrics a mixture of glue and gelatine is employed as dressing. Bad-smelling glue should not be used, as the odor cannot be removed from the garments.

Thoroughly boiled rice starch is an excellent dressing for men's and ladies' summer garments which have been wet cleaned. The articles are passed



through the starch bath at a temperature not above 86° F. Previous extracting is absolutely necessary, so that the dressing can be suitably thickened or thinned in accordance with the fabrics. When the dressing has been applied the articles are extracted, then stretched, dried, and ironed upon the wrong side under a wet linen cloth. The work is more easily effected by means of a steam-table. Dry cleaned garments seldom require dressing, and, if so, all that

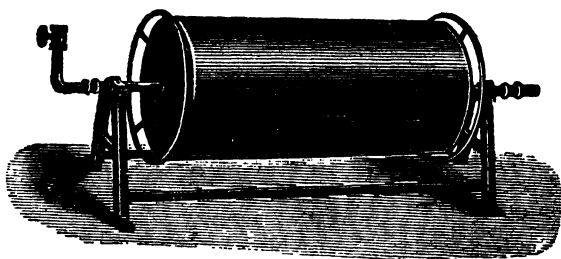


Fig. 20.

is necessary is to brush the lining with a moist sponge, and iron immediately.

All starched articles are ironed in an air-dry state, though very hard fabrics may have to be previously sprinkled.

Ladies' garments which have been ripped, as well as lighter articles of silk, half-silk, wool, half-wool, or cotton, after having been dressed with a suitable medium, are dried on a drying cylinder or drying table, the construction of which is readily seen from the illustrations, Fig. 20 showing a drying cylinder and Fig. 21 a drying table.

Fig. 22 shows steam-heated puff irons. They are tubular devices of various shapes and sizes, and are heated by steam. They are extremely simple in

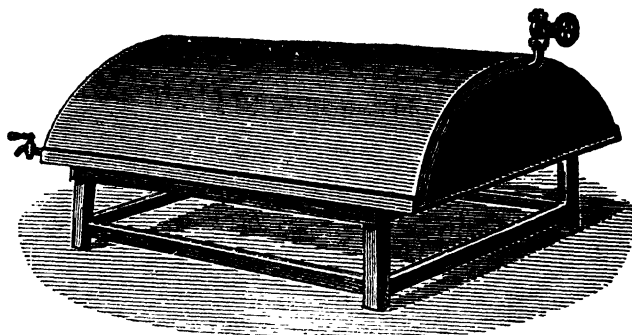


Fig. 21.

use, the articles being held tightly by the hand on the heated surface for a few seconds. They are employed for finishing the shoulders of coats, the sleeves

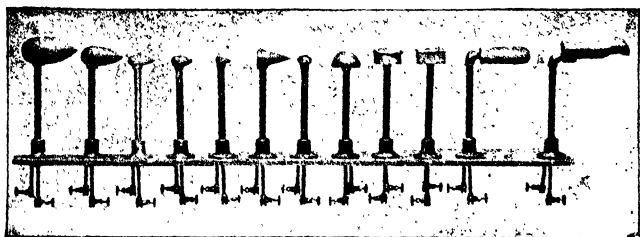


Fig. 22.

of blouses, etc., the fulness or irregularly shaped surface of any article which cannot be ironed satisfactorily, small frills of ribbons, lace, etc., trimmings on babies'

bonnets, in fact a finish can be easily and quickly given to many articles of ladies' dresses which is not readily obtainable in other ways. They require but very little space. The operator need not carry the work around the table. For use, it is only necessary to draw down the iron desired.

*Dressing for garment dyers and laundrymen.* For light woolens which have to retain to the full the characteristic feel of the material, pure gristle glue is the best dressing. Choose the glue as nearly free from color and odor as possible. The glue must be swelled in cold water, and then boiled before use. Add a little borax to preserve it, and also a little acetic acid and glycerine. The object of the acid is to preserve the glue solution. The thinner the wool, the stronger the dressing must be made. The solution is used warm, but not hot. For wool-silk, and all women's garments, the above dressing is about the best that can be had. In finishing half-woolens, glue is used in conjunction with clear-boiled starch and a little acetic acid. The finish is used cold, or at most lukewarm. If hot, it will strip too much of the dye from the cotton. The garments must be uniformly extracted after dressing, and hung up to dry without any creases. The drying must be at a moderate temperature, or the glue will show. Generally the cheaper fabrics used for men's clothing must be sized. A good dressing for these garments may be made from one gallon of warm water, one gallon of moss mucilage and one pound of starch.

In finishing pure silk use simply a solution of col-

orless gelatine, with the usual addition of acetic acid. The dressing is applied warm with a sponge or a very soft brush, and the drying is done at a very low heat. Care must be taken to apply the dressing evenly over the fabric. For black silk it is a good plan to add a decoction of curled mint as well as acetic acid to the latter. Half-silk is finished in the same manner.

There are many dressings for cotton and linen, but only a few of them are available on fabrics which have been made up into garments. Nothing is better than good wheat starch. A little glue can be added to it for colored cottons, and a little wax improves the subsequent feel.

*Gloss starch.* 1. Boil 9 lbs. pulverized borax, 3 lbs. stearine and 3 lbs. white wax in a proportionate quantity of soda lye of 20° Bé. to a liquid mass of uniform consistency, and evaporate to dryness. Mix the product thus obtained in the proportion of 1:10 with rice starch. The gloss starch thus obtained imparts to clothes starched with it a beautiful gloss and the stiffness of a board.

2. Rice starch, 100 parts by weight; pulverized borax, 5; pulverized boric acid, 2.6. Rub all through a hair sieve.

3. Pulverized starch, 1 lb.; pulverized borax, 3 ozs.; common salt,  $\frac{1}{3}$  oz.; white gum-arabic, 9 $\frac{1}{2}$  ozs.

4. *Elastic gloss starch.* Mix 100 parts by weight of wheat starch with 0.7 to 0.8 part by weight of stearine.

5. *Cream gloss.* Lard, 7 lbs.; ammonia of 0.88 specific gravity, 1 lb.; bleached beeswax,  $\frac{1}{2}$  lb.;

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glycerine of 1.26 specific gravity,  $\frac{1}{2}$  lb.; and a few drops of oil of citronella. Melt the lard and the wax, stirring constantly until the cooling mass acquires a salve-like consistency; then add the glycerine, oil of citronella, and ammonia, previously stirred together, and mix the whole thoroughly. Of this cream gloss add a small quantity to the starch.

*Chiffons* often require a dressing, but on account of the delicate nature of the material there is a tendency on the part of cleaners to rather overdo the matter, and as a result the garment does not present an appearance as good as would have been the case had no sizing been used. Any size that is used for chiffon must necessarily be very thin as well as colorless, otherwise its presence on the material will be too conspicuous. The following mixture serves the need very well and is used by many cleaners when sizing chiffon: Water, 150 parts; starch, 2 parts; white wax,  $\frac{1}{2}$  part; stearic acid,  $\frac{1}{2}$  part; castile soap, 1 part; sal soda,  $\frac{1}{4}$  part. All of the ingredients, with the exception of the starch, are mixed together and are dissolved in a small amount of water, after which the starch and the remainder of the water are added and the mixture boiled.

*Water-proofing fabrics.* 1. Boil  $\frac{1}{4}$  lb. white castile soap in 12 quarts of water, and, on the other hand, dissolve 6 ozs. of alum in 12 quarts of water. Heat both solutions separately to about 194° F. Then pass the fabric first through the soap solution, then through the alum solution, and finally dry in the air.

2. For making cloth, woollen, felt and cotton fabrics

impervious to water, the following mixture may also be used: Borax, 5 ozs.; fish-glue, 2 lbs.; sago, 1 oz.; salep, 1 oz.; stearine, 5 ozs., and water, 10 quarts.

3. *Another formula* for the same purpose is as follows: Dissolve 5 ozs. of alum in 3 quarts of water of  $176^{\circ}$  F. On the other hand, dissolve  $22\frac{1}{2}$  ozs. of lead acetate in  $1\frac{1}{2}$  quarts of water of  $158^{\circ}$  F. Mix the two solutions, allow to settle, and decant the clear liquor. Place the fabric in the liquor at the ordinary temperature for 24 hours, and then dry. The fabric acquires no odor and retains its softness.

4. According to another process fabrics of all kinds are rendered waterproof as follows: Dissolve 1 part of alum and 1 part of lead acetate in hot water, stir, and allow to stand till the fluid is clear, and then add a few drops of isinglass solution. The fabric is moistened and handled in the bath and then dried, if possible stretched in a frame, and pressed. For 50 quarts of water there will be required about 1 lb. of alum, 1 lb. of lead acetate, and 10 drops of isinglass solution. The bath is used warm.

5. For water-proofing coarse wool-stuffs, place the fabric for one hour in a cold 2 to 3 per cent. solution of aluminium sulphate, then extract and dry at a quite warm temperature. Then pass for 15 to 20 minutes through a cold soap solution ( $\frac{3}{4}$  oz. soap to 1 gallon water), extract and dry hot. If the fabric should show a white efflorescence too much aluminium sulphate has been used, and it has to be washed in cold water. If the fabric is treated twice, the first

aluminium sulphate solution may be used without further addition, but the soap solution must be fresh. It is advisable to neutralize the aluminium sulphate solution with a little soda till it shows a remaining turbidity. Such solution of basic aluminium sulphate is almost equal in its effect to aluminium acetate, and does not impart a rancid, acid odor to the fabric.

A waterproof finish is also obtained by placing the articles which have been starched with starch to which glue has been added, for a few hours in a 20 per cent. formaldehyde liquor.

*Fire-proofing fabrics.* Borax and alum were the first substances noted to have fire-proofing qualities, and although these are easily washed out of the goods, they are in common use for fire-proofing light fabrics. For coarse goods, theater scenery, etc., alum, borax, silicate of soda, calcium chloride and magnesium chloride are all used, the salt selected being dissolved and the solution added to the ordinary dressing. Tungstate of soda is an excellent fire-proofing material, and it has the peculiar quality of having an affinity for the fiber, whereby it becomes difficult to wash out after the fabric has been steeped in a solution of it. Unfortunately, it has the disadvantage of expense, and in modern fire-proofing processes the discovery, that salts of ammonia were more efficacious and much cheaper has led to the use of tungstate of soda being almost entirely abandoned.

Below some formulas for fire-proofing solutions are given:

1. Ammonium sulphate, 1 lb. dissolved in soft water,

8 lbs. This solution is very suitable for impregnating thin cotton or linen tissues, laces, etc.

2. Finely pulverize and mix ammonium chloride, 40 ozs.; borax, 10 ozs.; common salt, 5 ozs. For use dissolve the mixture in 16 times the quantity of hot water.

3. Ammonium sulphate, 4 lbs.; boric acid,  $1\frac{1}{2}$  lbs.; borax, 1 lb. Mix the ingredients in a dry state, and for use dissolve the mixture in the proportion of 8 to 100 in boiling water.

4. Borax, 15 lbs.; epsom salt, 11 lbs.; water, 10 gallons.

5. Alum, 5 lbs.; ammonium phosphate, 5 lbs.; water, 10 gallons.

6. Dissolve in soap water, alum, 6 parts; borax, 2; tungstate of soda, 1, and dextrine, 1.

*Fire-proofing starch.* A more simple method of impregnating fabrics that are more or less to be starched, consists in incorporating a salt that possesses fire-proofing qualities with the starch. The salt is dissolved by mixing it with the water required for the starch, and on steeping the fabric in the starch passes into the fibers, filling the latter. The articles are then ironed in the usual manner.

1. Sulphate of ammonia, 80 lbs.; ammonium chloride, 25 lbs.; boric acid, 30 lbs.; borax,  $17\frac{1}{2}$  lbs.; starch, 20 lbs.; water, 100 gallons.

2. Sulphate of ammonia, 25 lbs.; carbonate of ammonia, 30 lbs.; boric acid, 30 lbs.; borax, 20 lbs.; starch, 20 lbs.; water, 100 gallons.

*Martin's fire-proof dressing.* Dissolve in 100 parts



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of water, ammonium sulphate, 8 parts; ammonium carbonate,  $2\frac{1}{2}$  parts; boric acid, 3; pure borax, 2; starch, 2; dextrine,  $\frac{1}{4}$ .

The fabric is soaked in the solution of  $86^{\circ}$  F., then lightly wrung out, and dried. The quantity of starch as well as of dextrine may be changed as desired, according to whether the articles are to be made more or less stiff.

*Apyrine starch.* Ammonium sulphate, 8 ozs.; magnesium sulphate, 8 ozs.; wheat starch,  $7\frac{1}{2}$  lbs.

## V.

### CLEANING AND DYEING FURS, SKIN RUGS AND MATS.

CLEANING. Fur cleaning is an important branch of dry cleaning, and also one of the most risky, for the articles are sometimes of great value and cannot be treated like ordinary textile fabrics.

The furs should first be carefully examined in order to ascertain whether they are torn, damaged by moths, or whether any matches have gotten into them, the latter being a serious matter where the cleaning is to be done with benzine. As much dust as possible should also be removed by running them in a tumbler at a moderate heat. No other articles of wearing apparel should be in the tumbler when furs are in it. A further point to be considered is the color, and it depends entirely upon the dye which has been used whether the fur can be cleaned with soap and water or must be treated with benzine. The skin part must also be examined with the view of ascertaining whether it will stand washing.

Polar bear, tiger, leopard, lion, seal, rabbit, squirrel, dog, sheep and goat skins should be chemically cleaned, that is, washed in benzine, unless they are too badly soiled. White skins are best cleaned with benzine and

benzine soap, being brushed by hand. They should then be put into the extractor for about ten minutes. After this they should be removed, rinsed in fresh, clear benzine, and well shaken. Next place them upon a table and dry by rubbing in potato meal until the hairs are no longer damp and clammy. After allowing some time for the fumes of benzine to evaporate, the furs should be well beaten and the hairs combed out. Should the animal's head be still attached to the rug it cannot of course be washed in the machine, but must be cleaned by hand with a brush. Thorough rinsing is imperative. Furs never should be run in the washer with garments, as more or less hair will come out, which, if it gets on garments, is very difficult to remove. All gasoline in which furs have been cleaned should be strained before draining it back to the storage tank. After the skins have been well evaporated, they should be beaten and combed. Skins that have cotton interlining should be ripped apart, before cleaning, as the cotton soaks up much benzine and thereby wastes expensive material, and because it likewise harbors dust and often vermin. A thorough beating and a good washing will clean the cotton, which must of course be sewed into the skin after it has been cleaned. Steam never should be allowed to come in contact with the furs, however, for damage is very sure to result.

Furs and skins that are very dirty must be wet cleaned, and should also be beaten, repaired, and have the lining ripped off, the latter to be cleaned and then sewed on again.

Before commencing to wet clean furs the flesh side should be well smeared with oil or grease to prevent the leather from becoming hard and breakable under the action of the water. Practically any grease may be used for this purpose, the cheapest machine oil or cup grease serving the needs very well. The grease should be well worked into the pores of the leather and if possible the furs should be allowed to stand for a few hours after greasing and before commencing the cleaning process.

The furs then should be folded in the middle with the flesh side on the inside and kept in this position until the cleaning is finished, to prevent the grease from spreading over the hairs. The washing is done in a lukewarm bath, using a neutral soap and working carefully to prevent felting. Cleaning by hand is preferred to running in a machine. When clean the furs should be given two or more warm rinses, lightly extracted and dried in a moderately warm dry-room. When the furs are dry they must be dry cleaned to remove the grease. This is best done by working the furs in a pan of gasoline and squeezing out the surplus solvent. When the grease is removed the furs should be lightly extracted and finished by beating and combing. The leather should be soft and pliable after this treatment, but if there is any tendency towards hardness the leather should be lightly oiled, the surplus being removed by rubbing with a cotton cloth or with bran.

White furs require more care in handling than dark ones. As a rule, white furs are tanned with alum,

which is soluble in water. The following methods for cleaning white furs are used in one of the larger cleaning establishments in France: To each five or six gallons of benzine to be used for cleaning the furs is added one ounce of eau-de-cologne. This addition does not assist in cleaning the furs, its use in this connection being to neutralize the unpleasant odor that usually remains when furs are cleaned in benzine. The actual cleaning of the furs is done with the benzine to which has been added finely powdered borax in the proportion of two ounces of borax to each pint of the benzine. The mixture is well stirred and allowed to settle. A sponge is dipped in the mixture and the fur well rubbed, care being used not to saturate the padding. When the fur is cleaned it is partially dried by rubbing with a soft cotton cloth. Dry farina is now rubbed into the fur with a sponge. This operation is proceeded with until the fur is perfectly dry, after which the loose powder is brushed from the fur and the surface rubbed with magnesia and a soft rag. The fur is then allowed to remain in a warm place for a short time and is finished by brushing with a stiff brush.

Unlined skins are treated in a different manner. As the first step they are placed in an earthenware jar and covered with benzine, where they are allowed to remain for some time. A whiting mixture is prepared as follows: Fourteen ounces of whiting are placed in a receptacle and one gallon of cold water poured over it. Two ounces of pearl ashes are dissolved in boiling water and added to the first mixture, which is allowed to stand for twelve hours. At the end of this time

the water is carefully drained off and the mixture dried. When dry a few handfuls are placed in a pan and enough benzine added to make a thick paste. The furs are taken out of the benzine, the surplus solvent squeezed out and are thickly coated with the mixture of whiting and benzine. They are then hung up to dry, after which the whiting is removed with a stiff brush. Furs treated in this manner are said to present an exceptionally good appearance.

Where the skin has a head attached, wet cleaning is out of the question, for the water would dissolve the glue. White skins are best cleaned with benzine and talcum. Furs which are to be freed from moths and moth eggs without being cleaned should be exposed in the sulphur chamber.

Many furs cannot stand wet cleaning, being inclined to split and crack and drop their hair. Such skins come from over-fat animals or from such as have died of some disease; or they have been glued together; in any case they are difficult to distinguish from perfect ones until handled. It is better to clean such furs and skins cold, or to use benzine soap or benzine, and to clean them rapidly. Drying on the half-moon is also not advisable in this case. Neither should such skins be wrung out, but rather dried flat. Another method for treating skins is as follows: To keep the leather from becoming hard or from breaking, rub it well with clarified fish oil. Damp common salt well rubbed in also keeps the leather in good condition. Furs thus treated must be cleaned with cold soap baths and well rinsed. Polar bear and Angora skins

which have been bleached with hydrogen or sodium peroxidé should be treated in this manner. The bleach should not be excessively warm, as too much heat will affect the leather.

Skins cleaned with benzine must not be shaken too hard, it being well to allow them to retain a little benzine. They should then be laid, skin-side down, on a table and thoroughly rubbed down with talcum, which will restore to the fur its former freshness.

To soften hard and very dirty skins, proceed as follows: First of all, never wet clean them, but after ripping off all linings, sponge with benzine, taking care not to rub against the fur. After the worst dirt has been removed, the skin should be placed in a long trough, and a sufficient quantity of wheat flour poured over it and worked well into the fur. After an hour or so, the skin is taken out, care being had not to shake out too much of the flour; it is next hung up in the open air and beaten on both sides with a carpet beater. The wrong side is then oiled and the skin allowed to remain in this state for 24 hours. Should it still be hard, draw it over a perching knife; sift the remaining flour and keep it for another time if it is not too badly soiled.

Ladies' and gentlemen's fur collars should be washed in lukewarm suds, to which has been added a little ammonia, rinsed first in lukewarm water, next in cold water, and then finished in the usual way. White furs and boas are best cleaned in the machine with benzine and talcum.

*Sheepskins*, such as rugs, perambulator aprons, etc.,

are preferably washed with benzine soap, and in at least four cases out of five wet washing can be entirely avoided. The goods are brushed over with a strong solution of benzine soap, and then run through the washing machine for from 30 to 45 minutes. The subsequent rinsing with benzine should be very thorough, or the wool will retain a greasy feel.

If the wool is very dirty and has been much felted by long wear, the skin must be wet washed. The first thing is to take out the stuffing. The skins are then soaked in soft water for a time, and then spread out, and the coarser dirt is removed with a weak liquor of soda and ammonia. Then wring and work by hand with a good neutral soap. It is unnecessary to use brushes, as the fingers can get down to the leather more easily and quickly than a brush. More and more soap is poured over the goods till the lather remains quite white. As long as there are dirt and grease in the wool, the lather will feel sticky, and have a gray color.

Before each addition of fresh soap it is a good plan to rinse with weak soda, whereby considerable saving in soap is effected. The final rinsing, after completion of the washing, is done first with soda and then with clean water.

The whole series of operations is carried out on a bench on which the skins can be spread out flat.

After rinsing we come, with white skins, to the bleaching. Dyed skins must be soured to liven the color, using sulphuric acid for those which have been acid dyed, and acetic acid for those dyed with basic dyes.



Bleaching may be effected by means of potassium permanganate, sodium peroxide, or sulphurous acid, the latter being on the whole the best. In bleaching with a sulphur chamber no rinsing is necessary, as the more soap there is in the wool, the better the fumes of the burning sulphur act, but no dirty soap must be left behind in the wool.

For bleaching with potassium permanganate a dark reddish-violet solution is made with the permanganate and water, and the skin stirred in it for 20 to 30 minutes, when it assumes a dirty brown color. It is then removed, drained and immersed in a strong solution of sulphurous acid. If this bath is too weak, the skins will turn yellow all over or in places in the course of the next few weeks. The skins are finally rinsed, first with very dilute sulphuric acid and then with water to remove all trace of acid, and then dried.

With the use of sodium peroxide, all contact with metals except lead must be avoided. For every 100 lbs. of goods take 140 gallons of cold water soured with 10 lbs. of sulphuric acid, and slowly stir  $7\frac{1}{2}$  lbs. of the peroxide into the acid liquid. A test is then made with litmus paper, and if the bath is not neutral it must be made so by adding more peroxide or more acid as the case may be. Four pounds of silicate of soda of  $45^{\circ}$  Bé. are then diluted with a large quantity of water and added to the bath. Now enter the goods and raise the temperature to not exceeding  $90^{\circ}$  F. during one hour. Keep at the same temperature for another hour or two, lift, sour in very weak sulphuric acid—about 1 lb. of acid in 140 gallons of water—

rinse repeatedly in water, give a light soap bath, extract, and dry.

As extracting does not dry the leather which would become hard in the drying-room if placed in it very wet, the skin must be gone over with a special blunt knife to squeeze the water out as much as possible. Work with the knife towards the edge from the middle, and let the edges hang down for the water to drip from them. Repeat this once or twice, drying a little in the drying-room in the intervals.

Soap washing of skins should not be done at a temperature above  $70^{\circ}$  F. Drying is effected at  $70^{\circ}$  to  $75^{\circ}$  F. in a drying-room, or in the open air. The skins are stretched in a frame under tension. If in spite of all care the leather stiffens and becomes hard, rub a little oil well into it as soon as it is quite dry. Another and very excellent way of removing most of the moisture left after extracting is to stretch the fur hair down, flat on a table, and clamp it down. It is then covered to a depth of about half an inch with a mixture of equal weights of alum, common salt and meal. This absorbs nearly all the water, and after lying for about six hours can be scraped off. The skins of small articles can be kept soft by working them over a blunt knife-edge a few times during the drying. Very much tendered skins can sometimes be successfully washed and dyed if sewn for the time being on a piece of strong calico. The above-mentioned after-treatment with common salt and alum is quite unnecessary if stearine is well rubbed into the leather before the wet washing, but in this case the dried

skins must be chemically washed to remove the stearine.

A method for cleaning furs, such as *muffs*, *collars*, etc., which answers well even with white astrachans, is as follows: The furs have first of all to be made absolutely dry, as otherwise the subsequent treatment with benzine would be useless. In fur garments, not only the fur itself obstinately retains water, but water is also retained by cotton, wool, feathers and other accessories so frequently associated with furs in the shape of padding or ornament, and these also greedily absorb moisture from the air and retain it with great tenacity. However dry the goods may appear when received by the cleaner, they should be dried slowly at a moderate temperature.

When the goods are quite dry, all linings, whether of silk, half-silk or cotton, are thoroughly brushed over with benzine soap. They then get a benzine bath, in which a little soap has been dissolved, and are again brushed and twice rinsed, wringing well between the first and second rinse. They are then extracted.

If they are not quite clean at this stage, they return to the benzine bath, one or two turns are given, and they are again extracted. Care must be taken in extracting to get the speed up gradually, but at the last to use the maximum velocity obtainable. In this way, not only is the greatest possible amount of benzine saved for redistillation and further use, but solid impurities which the benzine has not dissolved are prevented from lodging in the fiber. After extracting, the goods are worked for about ten minutes

in warm starch powder. The starch absorbs nearly all the still-adhering benzine, so that when the goods are afterwards hung up to dry, the drying process is very rapid, even at a low temperature. This is the ideal method of drying. A low temperature which will not turn the goods yellow and requires little steam, does the work quickly so that time and fuel are both saved. The starch has the further advantage of giving luster to the furs, and improves the handle, that is, the feel of the goods.

Powdered gypsum is occasionally used instead of starch. It is of course far cheaper than starch, but its use cannot be recommended for any but the very cheapest class of goods, as the benzine left in the fabric causes the gypsum to impart to the furs a gritty feel.

After starching, the goods are dried with as much starch adhering to them as possible. The advisability of carrying out this drying in the sun, when it can possibly be done, cannot be too strongly insisted upon, especially with high-class furs. No matter how carefully the drying-room is managed, the furs leaving it are always inferior in softness and fulness of handle to those which have been dried in the open air. When the goods are quite dry, the starch is removed, first by gently beating, and then by thorough brushing. The brushes used must be soft and absolutely clean. They should be wrapped in clean paper and stored away where no dust can get to them when they are not in use, and should themselves be free from starch powder before being put away.

*Dyeing.* White sheepskins have to be dyed in every

imaginable color; furs proper are usually dyed brown, gray, blue or deep black. If a colored fur has to be re-dyed after cleaning, it is well, in order to be sure of getting the original color, to cut away a little of the hair which seems to show that color best before cleaning, and dye to it as a sample.

To increase the affinity of cleaned skins for dye-stuffs it is a good plan to immerse them for several hours in a cold, clear solution of bleaching powder. They are then rinsed in dilute sulphuric acid, an excess of which must be subsequently neutralized if the rugs are to be dyed with basic colors, the latter generally being employed with or without the addition of Glauber's salt to the dye bath. When acid colors are employed it is advisable to substitute formic acid for sulphuric acid. The temperature should not exceed 95° F., at which the dyeing takes from one to two hours.

Lamb recommends the following acid dyestuffs: Fast Red, Azo Fuschine, Acid Brown, Old Gold G, Quinoline Yellow, Alkaline Blue, Acid Green, Naphtol Green, Silver Gray N, Naphthalamine Black.

The following process for dyeing with acid dye-stuffs has been patented. The skins, well cleaned with soap, are rinsed in water and dipped in a solution containing chromium oxychloride, 1.8 ozs.; basic sulphate of alumina, 3.6 ozs.; common salt, 3.6 ozs.; acetate of soda (crystallized), 5.4 ozs., per 22 gallons of water.

After leaving the skins for a few hours in this liquor, which is sufficient for ten skins, the leather is tested by cutting to see if it has been properly saturated by the liquor; if this be the case another 3.6 ozs. chromium

oxychloride are added, and the skins are left in the liquor for 24 to 36 hours, being occasionally turned. They are then lifted, thoroughly rinsed, and extracted. They are then entered into a cold bath of  $1\frac{3}{4}$  pints hydrochloric acid per 22 gallons of water, where they are left for a quarter of an hour, and are then put in a clear bleaching-powder bath. After having been worked in the liquor for 20 minutes,  $\frac{3}{4}$  pint hydrochloric acid is added, and they are then worked for a further 10 minutes. They are then put back for another quarter hour in the first bath of hydrochloric acid, which has in the meantime been strengthened by the addition of a pint of acid. The skins are then well rinsed. To the last, lukewarm rinsing water, 3 to  $4\frac{1}{2}$  ozs. of hyposulphite of soda per 10 gallons are added, which is followed by a final thorough rinsing. After extracting the skins may be dyed with any acid dye-stuff in baths up to  $167^{\circ}$  F. without fear of damaging the leather. The dyestuffs must, however, be added slowly and the temperature must be low in the beginning, slowly rising to  $167^{\circ}$  F.

Independent of the coal-tar dyes, *gray* can be dyed by mordanting for from 2 to 4 hours in a bath containing from 30 to 70 grains of sulphate of copper per quart, and then dyeing in a fresh bath with logwood, shading if necessary with fustic or methylene blue. Fine grays can be obtained in every variety of shade in a tannin and iron bath. For *browns* and *blacks* it is best to use the various dyes especially intended for furs. The latter are not dyestuffs in the ordinary sense of the word, but so-called oxidation colors, *i. e.*,

colors which are developed upon the animal fiber by a treatment with oxidizing agents, such as iron chloride, permanganates, bichromates, hydrogen peroxide, etc. They are used as follows: Mordant in a bath containing from 30 to 62 grains of bichromate, 15 to 30 grains of tartar, and 5 to 6 grains of sulphate of copper per quart. Then rinse slightly and dye with the proper color.

A still better mordant for black than that given above is made with 23 grains of sulphate of iron,  $7\frac{1}{2}$  grains of sulphate of copper, and 15 grains of tartar per quart of water. Many furs have bristles, which must be killed. The killing liquid is made by dissolving 2 ozs. of sal ammoniac and  $\frac{1}{2}$  oz. sulphate of alumina in 2 quarts of hot water. The solution is then stirred into a mixture of 4 quarts of water and 7 ozs. of quicklime. It is kept covered up and applied to the hair side with a brush. It must on no account touch the leather. After drying, the dust is beaten out of the fur, and the dyeing is proceeded with.

Fur cuffs and other accessories to garments should be treated with the mordant, dye, etc., with a brush and not in the bath. All fur dyes are used with hydrogen peroxide, neutralizing the acid mixed with the peroxide with a little soda or ammonia. With blacks care must be taken, however, not to make the bath too alkaline, or the bleach will have a brown shade. For browns, bleaching powder can be used instead of the peroxide.

The fur dyes have their drawbacks as well as their advantages. They are poisonous, and often seriously

affect persons who work with them continuously for long periods. It is obvious that goods dyed with fur dyes must be thoroughly rinsed to prevent injury to the wearer of the fur. Badly rinsed dyeings also rub off a great deal. It is a good plan to follow up the rinsing with a bath of sulphate of copper—15 grains per quart—for an hour or two.

Combing after drying improves the appearance of many furs. Thibets and curly skins must of course not be combed. In some cases the dried skins are revolved with warm sand or sawdust in drums in order to clean away any extraneous dye, etc., which may be clinging superficially to the skins or the hairs.

As there is great variation in the size and weight of the skins, as well as in the quantity of hair attached to them, it is next to impossible to give definite quantities of dyestuffs and the following receipts are rather given for general guidance than for exact application. The best general rule to follow is to start with small quantities and add more if required, as shown by the dyeing operation.

1. *Black on skins.* a. Dye in a lukewarm bath containing 2 lbs. logwood extract for every 8 gallons and the necessary quantity of tumeric or fustic. After about two hours, lift, add to the bath 6 or 7 ozs. of sulphate of copper per 8 gallons; re-enter work another hour, lift, and rinse. Then partly dry the fur in dry, warm sawdust, nail it to a board, hair downwards, give the skin a slight rubbing with glycerine, and leave to dry. Supple the dried skin by stretching and beating. Finally comb the hairs with a clean



oily comb. To prevent any injury to the skin, the temperature should never exceed  $85^{\circ}$  or  $95^{\circ}$  F. throughout the operation.

b. Logwood extract, 50 lbs.; fustic, 9 lbs.; copper acetate, 5 lbs. dissolved in water, 80 gallons. Maintain the bath at a temperature of  $104^{\circ}$  F. Enter the skins and allow them to remain in this liquor for 3 to 4 hours. Then add  $1\frac{1}{2}$  gallons of black iron liquor and keep the goods in the solution until black, an immersion for 30 to 40 hours being usually required.

c. Logwood extract, 30 parts; sumac extract, 20 parts; copper acetate, 4 parts; iron liquor, 10 parts.

d. *Fur Black Standard and Fur Black Superior* give deep blacks. Prepare a cold mordanting bath of 10 gallons of water with 3 ozs. of bichromate and  $1\frac{1}{2}$  ozs. of tartaric acid. The furs are left in this bath for several hours and finally washed. The cold dye-bath is prepared with  $\frac{1}{2}$  pound of fur black, and 5 lbs. of peroxide of hydrogen per 10 gallons of water. The dyeing effect of these substances is produced by the addition of peroxide of hydrogen. The dyeing is done cold for several hours and the furs are frequently stirred during this time.

If the dyeing is to be done by brushing on the dyestuff, the furs, as a rule, will need no previous mordanting, but a much stronger solution of the dyestuff must be used. The dyestuff is applied to the dry fur by means of a brush.

2. *Brown on skins.* a. *Very dark brown.* Make a bath by dissolving 2 lbs. of paraphenylene diamine in 10 lbs. of methylated spirit. When the solution is

completed add 1 gallon of water. Just before use add to the bath a solution of 1 lb. of bichromate of potash in 2 gallons of water. Apply the complete solutions with a soft brush. In from 15 to 20 minutes the color is fixed, and the fur is rinsed with a damp sponge and dried. Hydrogen peroxide may be used instead of the bichromate.

Mordant the skins with  $\frac{3}{4}$  to  $1\frac{1}{2}$  ozs. potassium bichromate, and  $\frac{3}{4}$  to 1 oz. of cream of tartar, in 10 quarts of water. Then bring them into the dye-bath. Sample after 3 hours for a medium shade, and repeat the sampling from time to time according to the shade desired. A dark brown will be obtained in about 18 hours.

*b. Red brown (light shade).* Prepare a bath with 10 quarts of water,  $\frac{1}{3}$  oz. of fur brown, 5 ozs. of hydrogen peroxide and  $\frac{1}{4}$  oz. of ammonia. Place the furs, previously mordanted, as explained in *b*, in the bath for 6 hours, then lift and dry.

*3. Chestnut on skins.* Prepare a bath by dissolving 2 lbs. amindol in 10 lbs. methylated spirit. When solution is complete, add a solution of about 13 ozs. of carbonate of potash in 1 gallon of water. Before use add to the bath solution of bichromate in water as given under very dark brown. This applies also to the following:

*4. Russet on skins.* As given for chestnut, but use only half the quantity of potash and substitute for the amindol the same amount of paramidophenol.

*5. Golden on skins.* A pale golden-yellow is obtained in a bath made with 1 lb. of carbonate of

potash, 2 lbs. pyrogallie acid,  $\frac{1}{2}$  gallon water, and  $1\frac{1}{2}$  gallons methylated spirit.

6. *Silver gray on skins.* Prepare the dye-bath with 2 parts of Nigrosine and 20 parts of Glauber's salt.

7. *Scarlet on skins.* Prepare the dye-bath with 2 parts Azo Cochineal, 10 parts Glauber's salt and 2 parts sulphuric acid.

8. *Orange on skins.* Prepare the dye-bath with 1 part Crocein Orange, 10 parts Glauber's salt and 2 parts sulphuric acid. This gives a full bright shade.

9. *Bright green on skins.* Make the dye-bath with 1 part of Green Crystals,  $\frac{1}{4}$  part Auramine, and 10 parts Glauber's salt.

10. *Maroon on skins.* Use for the dye-bath 1 part Magenta, 10 parts Glauber's salt, and a little Nile Blue.

The skins, etc., when cleaned and dyed, have to be dried, and for this purpose should be stretched so as to prevent shrinkage, which causes them to become hard. While drying they should occasionally be shaken to open out the fiber and prevent matting. When dry the hair side should be well brushed to separate the hairs as much as possible. It is also advisable for the purpose of softening the skins to rub the flesh side with a little castor oil, or a mixture of castor oil and yolk of egg.

## VI.

### CLEANING AND DYEING FEATHERS.

CLEANING. Feathers which have been previously dyed and simply require cleaning, are best washed in a weak lukewarm soapbath, made by dissolving a piece of good castile soap in warm water, well working and drawing through the fingers or hands; and finally rinsing them in soft warm water. The soap liquor should not be too warm, a hand-heat being quite sufficient. Too hot a liquor might result in taking some of the color off the feathers, which would necessitate re-dyeing. Pale-colored feathers should be treated in a very weak and cold soapbath. A little ammonia added to the bath is beneficial.

Blacks, browns, and most ordinary dark colors, can often be brightened by an immersion for ten to twenty minutes in a warm decoction of logwood, followed by rinsing; this will usually be sufficient preparation for the dressing and drying processes. Dry cleaning processes are of little use in treating feathers, but the feathers may be chemically purified. For this purpose they should be placed in a somewhat long and narrow china basin containing benzine and

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raw potato starch, which is insoluble in the liquid, and the feathers moved about rapidly in this bath. This mixture serves to dissolve the fatty and other obnoxious materials on the feathers. These impurities pass into the solvent, and the feathers are afterwards taken out and dried, the starch being removed by shaking them out. After having been cleaned as systematically as possible, the feathers should be brushed, and finally dried in the open air, if possible. They must be exposed until all the benzine odor has disappeared.

The dressing of feathers consists in passing them several times in a liquor of raw (unboiled) potato starch, then pressing them carefully and evenly between two sheets of clean white blotting or filtering-paper or linen cloth. The passing of the feathers through the liquor may be repeated as many as eight or more times. Feathers and articles made of feathers, such as boas, stoles, etc., which have been cleaned or dyed, have a very bedraggled appearance when wet, the hairs or "flues" of the feathers being matted together. To open up the flues the feathers are dipped in cold water containing starch or farina. After drying in the open air or by means of artificial heat, the starch is gently beaten or shaken out, and the flues open up to their original condition and are ready for curling.

Natural white feathers are re-whitened by half an hour's careful treatment in a tepid soap bath, after which they must be thoroughly washed in a fresh warm soap bath with a strong lather. They subsequently

have to be washed three times in a warm water bath, and then placed for about a quarter of an hour in a weak clear, and cold oxalate of potash or ammonia bath, and afterwards passed through a weak solution of Prussian or Paris blue, in order to neutralize the yellow tone produced through the action of the cleaning agents.

The feathers are next pressed between blotting-paper and dried in the open air. Raw white feathers must be first thoroughly freed from fatty matters by means of strong soap and alkaline solutions, and this treatment is especially required when the feathers have to be dyed, as otherwise an even color cannot be obtained. The quills should be separately treated previous to the cleaning process. This treatment consists simply in rubbing them with a solution of bicarbonate of ammonia or oxalate of ammonia. Thorough working in benzine is also good for removing grease from new feathers.

Sometimes good white feathers or feathers which are to be dyed in pale tints require bleaching. This can be done by burning sulphur or by preparing a bath of hydrogen peroxide, adding a little ammonia to make it alkaline, steeping the feathers in this over night, and the next day heating at about 150° F., and allowing to steep for some hours in the warm bath, after which they require only rinsing. If not sufficiently bleached, repeat the treatment. Feathers which are to be dyed black, or dark greens or browns, need only to be scoured simply in a tepid soda bath to remove grease; then, before dyeing with the de-

coctions of the dyewoods they are mordanted with a solution of permnitrite of iron.

*Dyeing.* Before proceeding to deal with the dyeing process for feathers, it is necessary to say a few words in regard to the utensils which can be used with safety and with the greatest practical advantage for these operations. A knowledge of the chemical composition of the various articles used by the dyer is most desirable not only by those who supervise the work as a whole, but also by the individual operator. He should be well acquainted with the chemical and mechanical action of the various chemicals and materials used on the feathers to be dyed. The color shades got in many instances are of a totally different tint from that which was intended to be produced, and the actual cause is either to be found in the action of chemicals used for mordanting and dyeing, and possibly for cleaning the feathers, or in the quality of the water used, or in the injudicious choice of mordanting and dyeing materials, or using one or other of these in too large quantities, to say nothing of adding wrong materials. As feathers belong to the category of animal products, like wool and silk, they can only be dyed in full shades by the use of a somewhat high temperature, but boiling heat need only be used for dark colors, and it is best to keep the heat as low as possible.

When feathers are boiled while in the dye-bath, the ebullition of heat seems to have a tendency to open the pores of the fibers, and thus allow a free access to the interior of the feather by the mordants

or dyes. If desirable, the mordants can be used before or after the actual dyeing operations. It is, in many cases, very advantageous to use the mordant before dyeing as well as concurrently with the dye. The application of too large a quantity of mordant must, on the other hand, be avoided, as in using iron and bichromate mordants such excesses are likely to produce rusty greenish or gray hues. Another very important point demanding attention is the fact that the finer the feather the more dye is required for the production of the desired shades. This is one of the greatest difficulties to be encountered by the dyer, for it is no easy task to decide at once how large a quantity is necessary to produce the desired shade.

For light colors a strong and finely glazed china basin of a white color is best adapted for dyeing. Metal utensils can be used, but the former are best for delicate colors, and a sufficient amount of heat can be produced by means of a water-bath. The inside of the vessel should, however, be as light as possible, and the application and additions of dyes effected with the utmost caution.

The color tones can be accurately discerned and regulated in such a white basin. If perfectly enameled metal basins are used, the action of the chemicals cannot affect the enamel, and the penetration to the metal itself is almost an impossibility.

The temperature can be regulated by using a water-bath, and can be maintained at 167° to 176° F., which is quite sufficient for pale tints. Boiling heat is, on the other hand, usually required in producing dark



colors for shades on feathers, and copper vessels or kettles with a double bottom are best adapted for the purpose. Such utensils are sometimes heated by being placed on hot plates, and a continuous heat is thereby maintained during the process of the operations.

Well-enameled vessels of an oblong shape are best to use, as these are especially adapted for placing the feathers in full length without any bending.

For all colors except black and a few light colors, the acid coal-tar colors should if possible be used. Feathers dyed with these colors, after being once or twice rinsed, are finally drawn through a bath acidulated with sulphuric acid and then dried.

With ostrich feathers or large fancy feathers, the addition of coloring matter is best effected by placing the articles in a sieve, or a willow-ware basket, since if they remained in the kettle they would break and tear in consequence of the necessarily rapid handling, and, besides, would spot. The dissolved coloring matter is added to the dye-bath, stirred, and the sieve or basket containing the feathers is placed in it.

For smaller fancy articles, such as chicken feathers and small wings, the addition of the coloring matter is effected as follows: Bring the dissolved coloring matter into a copper pan which holds 1 to 3 quarts and is provided with a long handle. Fill the pan with dye-bath or water and quickly plunge it, whilst constantly stirring the feathers, into the kettle, emptying it on the bottom. A better, but more trouble-

some, method is as follows: Pour one-third or one-half of the dye bath through a sieve into a kettle, so that the feathers remain behind; then add the coloring matter, stir thoroughly, and return the whole, with constant stirring of the feathers, to the kettle. In this manner a very uniform and rapid distribution of the coloring matter is effected.

The dyeing of fancy feathers differs in several respects from that of ostrich feathers.

The portions of birds, such as the goose, duck, kingfisher, penguin, pelican, etc., used in the manufacture of ornamental feathers, require for dark colors a greater affinity for the coloring matter than they naturally possess. This is produced by the addition of sulphate of sodium (Glauber's salt) to the acidulated dye bath, bisulphite of sodium being thereby formed, in consequence of which the fiber is more disintegrated and absorbs the coloring matter more uniformly and to a greater degree.

Moreover, the feathers of the above-mentioned birds require greater heat, and may gently boil for from  $\frac{1}{4}$  to  $\frac{1}{2}$  hour. But this cannot be done with articles containing portions of flesh, sinews, or skins, since they would dissolve and the articles fall to pieces. For skins, birds, heads, wings, etc., the heat employed should not exceed  $167^{\circ}$  F. In such cases the advantage of greater heat must be compensated by the greater strength of the bath.

Ostrich feathers are tied together by the lower ends of the quills in bundles of from 3 to 5, and 30 to 40 of such bundles are strung together.

## DYEING OSTRICH FEATHERS.

1. *Cleaning.* a. *Large feathers.* The feathers are soaked in a strong solution of castile soap at 100° F., for one hour, or, still better, over night, and then washed upon a washboard for 10 minutes. They are then brought into a weak soda bath of the above-mentioned temperature and treated in the same manner. The entire manipulation is then repeated with fresh baths, when the feathers are thoroughly rinsed, drawn through a bath acidulated with sulphuric acid, and again rinsed.

b. *Feathers in bulk.* For 10 lbs. of ostrich feathers prepare a bath of 5 lbs. of crystallized soda dissolved in 50 quarts of water, and add a small quantity of ammonia. Heat the bath to 100° F., introduce the feathers, and allow them to remain for 4 to 10 hours. Cover the vessel with a lid fitting in it, so that the feathers remain completely submerged. Then wash the feathers piece by piece, upon a washboard, rubbing them quite strongly. Then treat them in a second bath of 7 lbs. of crystallized soda and a little ammonia, though they need not remain in this bath as long as in the first. After again washing, the feathers are several times rinsed in cold water and then in warm water, drawn through a lukewarm bath acidulated with sulphuric acid, and again rinsed.

2. *Decolorizing.* The feathers cleaned in the above-described manner are laid flat in a bath of 50 per cent. peroxide of hydrogen, 3 per cent. ammonia, and 47 per cent. water heated to 100° F. The am-

monia is added after the bath has acquired the above-indicated temperature. A glass or stoneware vessel should be used for the bath. Work the feathers thoroughly in the bath, let them rest a moment, and work again. Then allow them to rest  $\frac{1}{2}$  hour, and work once more.

The bath should be protected from the light, and, while resting, the feathers must be submerged. This is effected by placing a lid fitting in the vessel upon the feathers and loading it with a weight.

When the bath is perceptibly exhausted, *i. e.*, when the bleaching process no longer progresses, the feathers are taken out and the treatment above described is repeated with a fresh bath. The originally gray or black feathers will finally appear white. They are then taken out, rinsed in several waters, and finally drawn through a bath quite strongly acidulated with sulphuric acid. They are then again rinsed, and have now the ground required for all light colors. If they are to be used white, they are slightly blued.

3. *Degreasing.* After cleaning the feathers according to the directions given under *1 b*, they are brought into a bath which, for 10 lbs. of black ostrich feathers, is prepared as follows: Pour into a stoneware vessel of 100-quarts capacity, 75 quarts of cold water, then add the solution of 10 lbs. of chromate of potassium, and finally 5 lbs. of pure sulphuric acid of 66 degrees. After stirring thoroughly, lay the feathers flat in the bath, turn them over, and cover the vessel. They are then turned over every hour until the natural color is uniformly stripped off and the feathers show a light color.

Care must be taken not to allow the feathers to remain in the bath longer than necessary for the removal of the natural color, and also not to keep the bath too hot. In both cases the feathers are attacked and may very easily become entirely worthless. The heat should not exceed  $89^{\circ}$  F. The feathers are now rinsed in two cold, and several warm, baths. The warm rinsing baths being used for the purpose of more rapidly removing the potassium, the feathers are left in them for some time. When the chromate of potassium has been completely removed, the feathers are worked in an oxalic acid bath for  $\frac{1}{4}$  hour and rinsed. They are then worked in a bath of 2 lbs. of castile soap, and rinsed in several warm baths. The feathers are now sufficiently prepared for the uniform reception of all medium and dark colors. Gray ostrich feathers require only half the quantity of chromate of potassium and sulphuric acid.

4. *White.* In case the white of the feathers cleaned, according to directions given under 1 a, is disfigured by natural brown spots and points, they are brought into a bath of  $100^{\circ}$  F., to which from 10 to 20 per cent. of peroxide of hydrogen has been added. They are taken out after half an hour or an hour and brought into a bath of 3 per cent. potassium bisulphide heated to  $110^{\circ}$  F., where they remain for half an hour, when they are taken out and brought into a bath acidulated with sulphuric acid. They are then rinsed and drawn through a cold bath to which a small quantity of Aniline Violet, dissolved in alcohol, or Maine Blue, has been added.

It may be remarked that the more yellowish the white appears, the more of a reddish hue the blue to be used should have, otherwise a greenish tint is readily produced.

5. *Dyeing black.* a. For  $\frac{1}{2}$  lb. of feathers prepare a bath by dissolving  $\frac{3}{4}$  oz. of calcined soda in 50 quarts of water of  $86^{\circ}$  F. Rub the quills with a piece of ammonium carbonate and place the feathers in the soda solution, allowing them to remain in it for  $\frac{1}{4}$  hour. In place of the soda, double the quantity of ammonium carbonate may be used and the feathers allowed to remain in the bath overnight.

After taking the feathers from the bath, rinse in cold water and place them for 5 to 6 hours in a nitrate of iron bath of  $7^{\circ}$  Bé. Then take them out and rinse in cold water. Boil 2 lbs. of logwood and 4 lbs. quercitron, and enter the feathers in the lukewarm bath.

Work them in the bath just below the boil until the black is developed, when they are taken out and rinsed in lukewarm water. Finally, dissolve  $3\frac{1}{2}$  ozs. of potash in 6 quarts of water and stir 8 ozs. of oil into the solution so that the oil is evenly divided. Draw the feathers separately through this bath, allow to drain off without squeezing, and swing them.

b. Place the degreased feathers in a cold bath prepared by adding 1 part of red-iron liquor (nitrate of iron)  $41.2^{\circ}$  Bé. to 3 parts of water and allow them to remain therein overnight. Then wash them well, using for the last rinse water containing a little ammonia. Make up a logwood bath as follows: Logwood

extract, 1 part; water, 200 parts. Soap may also be added.

Work the feathers in the bath just below the boil until the black is developed. Then rinse them in water, followed by a warm soap bath. After rinsing in warm water place them for 2 or 3 minutes in a cold bath of potassium dichromate ( $\frac{1}{2}$  per cent. solution) and then rinse well.

c. Black can also be dyed by using for 11 lbs. of feathers a bath containing 1 lb. Neutral Wool Black 4B, 2 ozs. Indian Yellow G,  $1\frac{1}{2}$  lbs. Glauber's salt, and 1 lb. sulphuric acid. This yields a fine, full, jet-black, very fast. One advantage of using this method over the logwood process is that the feathers are left softer and in a better condition for finishing.

6. *Bronze.* a. *Green.* The feathers dyed black according to the directions given under 5 a are brought into a bath of  $100^{\circ}$  F., to which, for every 11 lbs. of feathers, a solution of 7 ozs. Magenta crystals has been added. After heating the bath to  $167^{\circ}$  F., manipulate the feathers in it until they show a beautiful, lustrous green-bronze. Then take them out and rinse.

b. *Olive.* Treat as above with a dye-bath consisting of  $3\frac{1}{2}$  ozs. of Diamond-Fuchsine and  $2\frac{1}{2}$  ozs. of extra superfine Aniline Violet 6B.

c. *Gold.* Treat as above with a dye-bath consisting of  $1\frac{3}{4}$  ozs. of Fuchsine powder and  $5\frac{1}{4}$  ozs. of extra superfine Acid Violet 6B.

7. *Other colors, including fashionable colors.* a. *Cream, ivory.* Naturally white or thoroughly decolorized feathers are dyed in a "hand-heat" bath,

to which a very small quantity of dissolved Pale Yellow has been added. Final shading according to sample is effected with a very small quantity of Orange.

It may here be remarked that all the vessels used must be thoroughly cleansed, especially when used for light colors.

*b. Rose.* Dye the pure-white feathers a yellowish-rose with a very weak solution of Eosine or Safframine, shaded, if necessary, with a pale yellow, such as Auramine or Metanil Yellow. The dyeing should take place in a neutral bath having a temperature of  $167^{\circ}$  F. If the sample is bluish, shade the Eosine with a drop of violet, using for this purpose either Methyl Violet or Acid Violet Bluish.

*c. Salmon.* Dye with a solution of Eosine and Pale Yellow in a neutral bath of  $167^{\circ}$  F. Shade according to sample with both coloring matters.

*d. Maise, bamboo.* Dye the white feathers in a bath to which sulphuric acid, Azo Yellow, and a little Acid Orange has been added, heating up to  $190^{\circ}$  F. For bamboo add a little more orange than for maise. Final shading is effected with the above-mentioned dyestuffs, according to sample.

To all acid dye-baths only so much sulphuric and tartaric acids should be added that a small excess is perceptible to the taste.

*e. Pale blue.* Manipulate for a quarter of an hour the cleansed white feathers in a bath to which a weak solution of extra superfine, water-soluble Pale Blue has been added, heating up to  $190^{\circ}$  F. Then take out the feathers and add to the dye-bath sufficient



sulphuric acid diluted with cold water to give it a slightly acid taste. Then replace the feathers, handle them for some time, and, if necessary, add coloring matter until the sample color has been obtained.

*f. Butter, bouton d'or, mandarin, coq roche.* The feathers decolorized, or eventually freed from grease, are brought into a bath of 145° F. to which some sulphuric acid, Azo Yellow, and a little Orange have been added. Handle thoroughly and effect final shading with the above-mentioned coloring matters.

For *bouton d'or* a little Blue may also be employed; for *mandarin* quite a considerable quantity of Orange; and for *coq roche* much Orange and some Ponceau. The bath is heated to 200° F.

*g. Parme, heliotrope, prune.* The feathers are dyed in a bath acidulated with sulphuric acid and heated to 145° F., with Acid Violet R and Acid Violet 6B. According to whether the sample is clearer or duller, final shading may also be effected with Acid Fuchsine, Fast Red, Ponceau, Orange, and, on the other hand, with Indigotine. Heat to 200° F.

*h. Gold, old gold.* White feathers are dyed, according to sample, in an acidulated bath at 145° F. with Azo Yellow, Orange, Indulene.

*i. Gray.* For the paler shades, white feathers are taken, and for the darker, feathers freed from fat. They are dyed with Aniline Gray, extra superfine, and sulphuric acid at 200° F. Shade according to sample with very small additions of Fast Brown, Orange, Azo Yellow, etc.

*j. Coquelicot, cardinal.* Dye the feathers, either

white or freed from fat, according to sample, with sulphuric acid, some tartaric acid, Ponceau 3R and Carmoisime, at 200° F.

*k. Garnet.* Treat like the preceding, but according to sample; use for yellow tones red coloring matters with a yellow tinge, such as Orange, Ponceau with Indigotine; and for blue tones coloring matters with a bluish tinge, such as Fast Red, Acid Fuchsine; also Acid Violet, or Navy Blue.

*l. Beige, tobacco, Siam, and intervening shades.* Feathers freed from fat may be used. Heat and acidity of the bath as usual. Dye with Azo Yellow, Orange and Indigotine. Fast Brown as well as Fast Red, Ponceau, or Indigo Blue may be used as required.

*m. Chartreuse—pale yellow green.* Dye white feathers, according to sample, in a bath heated to 200° F. with sulphuric acid and Acid Green.

*n. Cresson—dull yellow green.* Dye in the ordinary acidulated bath with Azo Yellow, Acid Green, and Aniline Gray, extra superfine, as well as eventually with some Orange. Heat to 200° F. Shade according to sample, if necessary, with Indigotine or Indulene.

*o. Olive.* Dye with Azo Yellow, Orange, and Acid Green in the acidulated bath, at 200° F. Shade, if required, with Indulene and also Fast Brown. Feathers freed from grease may be used.

*p. Vesuve, Etna—dull, fiery tones.* Dye, according to sample, white feathers, or feathers freed from grease, in the ordinary bath with sulphuric acid, Ponceau, Orange, and eventually Azo Yellow, as well as for bluing, with Indigotine, or Acid Violet. Much

red and yellow coloring matters give a deep, fiery tone.

*q. Old-rose* belongs to the so-called distemper colors. Dye in the ordinary bath, according to sample, with Carmoisine, Ponceau, or Orange, and a pure shade of greenish-blue.

*r. Navy, admiral.* Dye with Indigotine, Victoria Blue, and Navy Blue of best quality. Besides these coloring matters, final shading may also be effected with Acid Violet and Acid Fuchsine. Acidity and heat of the bath as usual.

*s. Russe.* Dye in a bath acidulated with sulphuric acid with Azo Yellow and Acid Green. Shade with Brilliant Blue, greenish, eventually also with Navy Blue, and, to give the tone some warmth, also with Orange. Heat to 200° F.

*t. Gray-blue colors.* Water-soluble Aniline Pale Blue, with Gray, extra superfine, in a bath acidulated with sulphuric acid. Shade, according to sample, with Acid Violet, Brilliant Blue. Acidity and heat as usual.

*u. Green-blue colors.* Pale Blue, Acid Green. Shade, according to sample, with Azo Yellow, Brilliant Blue or Victoria Blue, also Orange. Acidity and heat of bath as usual.

*v. Maroon loutre.* Dye in the ordinary bath with Orange and Pensée Lake. Shade with Azo Yellow Acid Brown and Indigotine as well as Navy Blue.

*Remarks.* From *d* on, the bath, if not otherwise mentioned, is always acidulated with sulphuric and tartaric acids, so that a slight excess of them can be detected by the taste. The temperature of the bath

is at first kept at  $145^{\circ}$  F., and in the dyeing increased to  $200^{\circ}$  F.

8. *Ombré (shaded) tri-colored.* Dye the feathers the palest color of the sample, which is generally on the point. Then, for the reception of the second color of the sample, stretch the feathers in a frame, which is effected as follows:

Take two strips and place them across the shading-box described below, so that they project about 2 inches on each side. The strips may be either of wood  $1\frac{1}{4}$  inch thick, or of stout sheet copper. One of each pair of strips is provided near each end and in the center with copper screws which accurately fit into holes in the other strip. Cover the strip provided with screws with a rubber strip of the same size, and upon the latter place feathers alongside one another up to the end screws. Now place upon them another rubber strip of the same size as the first, and fit the other copper strip upon the screws. Then screw both strips together by means of strong nuts, so that the intermediate space not occupied by feathers is filled up with rubber.

The entire lot being thus stretched in strips, the feathers are taken to the shading-box, which consists of a rectangular copper box about  $25\frac{1}{2}$  inches long,  $19\frac{1}{2}$  inches wide, and  $3\frac{3}{4}$  inches deep. It is placed in an exactly horizontal position over the fire, or a steam-pipe is introduced. The box is filled about one-quarter full with water, which is acidulated, and the required coloring matter for the second color to be dyed is then added. When the dyebath has

acquired the required temperature, place the strips with the feathers across the box, so that the feathers are about three-quarters covered by the dyebath. Now dye at 200° F., occasionally shaking the strips with feathers, so that the coloring matter may penetrate as uniformly as possible, and the boundary between the two colors be not too sharply defined.

When the second color has been dyed according to sample, the strips are unscrewed and the feathers shifted. This is effected by drawing them uniformly forward, so that, with the shading-box filled to about the same depth, the darkest (third) color can be applied to full one-half the length of the feather. The strips being again screwed together, are replaced upon the shading-box, the latter now containing the darker dyebath.

It may here be remarked that for *ombré*, as well as *bordé*, indigo preparations, such as Indigotine, should be avoided as much as possible, they possessing the property of very readily running into the neighboring pale color, and thus giving a bad appearance to the boundary. Hence, for dark colors it is best to use Navy Blue, Violet 6B, Gray, Acid Green, Nigrosine, etc.

The last color having been dyed, a wide vessel is prepared for rinsing. The bath should be slightly acidulated and the feathers, stretched in the frame, rinsed as far as they project from the latter. The object of this is to remove any loosely adhering dark coloring matter before the feathers are removed from between the strips, otherwise there might be danger of the pale colors of one feather coming in contact

with the dark color of another. The feathers are finally taken from between the strips and thrown into an acidulated rinsing bath. When rinsed they are taken out, care being taken that the colors of the same shade lie alongside one another. The feathers are then immediately strung together, swung to and fro, and dried.

9. *Bordé (bordered feathers).* a. *Light mirror, dark border.* The cleaned naturally white or decolorized feathers are dyed in accordance with the light mirror of the sample. Three to five of them are then placed one upon the other upon a narrow, four-cornered stick, so that the quills cover one another, and the latter are firmly tied in three places to the stick with twine. When the feathers are spread out, their points and side branches then hang down. Now bring hot water into a suitable shallow dish, or, for larger lots, into the shading-box, acidulate, and add the coloring matter required for the dark border. Then place the stick, to which the feathers are secured, over the vessel, so that the feathers dip in the dyebath as far as the border is to extend. After dyeing at 200° F., take the feathers out, rinse in an acidulated water bath, draw through starch water, swing to and fro, and dry.

b. *Dark mirror, light border.* Dye the feathers in accordance with the light border of the sample, and dry without starching. Then firmly tie several thicknesses of paper around the border. The feathers thus protected are then dyed in the ordinary manner in accordance with the dark mirror of the sample.

The operation must be performed as rapidly as possible to prevent the protecting cover of the border from soaking through and thus spoiling the latter. Then rinse in a clean water bath, next in one acidulated with sulphuric acid, and, after removing the paper, rinse once more. The feathers are then strung together, drawn through starch water, passed through the extractor, and dried.

Another method of protecting the first color in the second dyebath is as follows: Take a copper plate, similar to those used in shading, but somewhat shorter and wider, and provided only on each end with a screw, which should, however, be about 4 inches long. Several other copper plates of the same size as the one above described are required. They are, however, only furnished with holes in which the screws of the first plate accurately fit.

Now place the feathers, spread out between two rubber plates of equal size, and the shape of the portion of the feather to be protected, upon the first copper plate, lay upon it another plate, then a feather between rubber plates, upon this another copper plate, and so on, alternately, as many feathers between rubber plates and copper plates as the lengths of the screws will permit. Now screw the whole together with strong nuts and dye in accordance with the dark mirror of the sample. After dyeing, rinse, and in the second rinsing water, which should be acidulated, take the feathers from between the plates. The feathers are then strung together, drawn through starch water, passed through the extractor, and dried.

It is advisable first to soak the rubber plates in hot water so that they become quite soft.

The above-mentioned method has the advantage that the feathers can be protected wherever desired, and by the use of properly shaped rubber plates any required design may be produced. Another method of producing contrasting colors, however, without special design is as follows: Firmly wrap twine around the feathers so as to leave a few places free, and dye. The places protected by the twine will remain colorless, or retain the color previously applied, while the places left free will show the new color. By now freeing about one-half of the protected portion from twine, and partially covering the previously applied color, and again dyeing, four different colors will be obtained. By thus continuing the manipulation, and carefully choosing the tones so that the colors alongside one another contrast, feathers showing all possible tones may be obtained.

Feathers may also be dyed in graduating shades, beginning at one end with a very pale shade and finishing in a dark shade of the same color, as follows: Prepare a weak dyebath and dye the whole feather a pale shade. The bath is then slightly strengthened and three-quarters of the length of the feather is dipped in it, and so on, gradually strengthening the bath and then immersing less of the feather, until only the end is dyed in the last bath. The same effect may be produced by the following method: Make up the bath sufficiently concentrated to dye the dark shade on the end of the feather, and reduce the strength



in stages by diluting with water and immersing more and more of the feather.

#### DYEING FANCY FEATHERS.

1. *Cleaning.* With the exception of ostrich feathers, the term *fancy feathers* is applied to all kinds of feathers used in the manufacture of ornamental feathers, hence including those from nearly all kinds of birds. There being considerable difference in the content of fat, various methods of cleaning have to be employed. The treatment in dyeing also varies somewhat, since the feathers of many birds show a different behavior towards the coloring matters.

Chicken feathers containing no fat need not be washed, at least, not for dark colors; they only require, before dyeing, to be thoroughly moistened in a hot-water bath acidulated with sulphuric acid. However, it is recommended to once or twice wash all feathers which are to show luster, in a bath of castile soap.

On account of their content of dirt, most fancy feathers require thorough washing, which is effected as follows:

For 11 lbs. of feathers prepare a bath at 100° F., to which add 26½ ozs. of good white soap, thoroughly dissolved. Stir the feathers in this bath for about 10 minutes, and then let them stand, well covered by the bath, for about one hour. Then, after stirring a little more, bring them into a sieve.

Now prepare a fresh bath of the same temperature, to which 3 lbs. of castile soap, well dissolved, have been added. Handle the feathers well in this bath and then let them stand for one hour, after which they are again thoroughly handled and brought into a sieve. They are then passed in succession through two baths of 100° F., to each of which has been added 1 lb. of soda, well dissolved. They are handled 10 minutes in each bath. They are then rinsed in two cold-water baths, next in one acidulated with sulphuric acid, and again rinsed in clear water, when they are ready for dyeing. Skins, heads, wings, etc., must be more rapidly handled, and are not worked in the soda-baths, as the fleshy sinews and skin would be dissolved. They are washed for a time in a good soap-bath, rinsed in warm water, and then in water slightly acidulated. White skins, wings, etc., intended for light colors, are washed in two quite concentrated soap-baths, then in two very warm water-baths, rinsed first in slightly acidulated, and finally in cold, water.

2. *Decolorizing.* Decoloration is made use of only for wings and bird skins, and for some larger, more valuable varieties of feathers. The process is the same as given for ostrich feathers, which see.

3. *Degreasing.* The process is the same as given for ostrich feathers, but is of greater importance here, it frequently being the initial and final operations, after which the articles are ready for the manufacturer. The bath is used according to the various natural designs of the skins, wings, and feathers, the result always being an agreeable tone. The white

mixed with the natural design usually suffers somewhat from the chromate of potassium, but is restored by the subsequent saccharic acid bath.

4. *White*. White fancy feathers are brought into a bath of  $100^{\circ}$  F., which, for every 10 lbs. of feathers, contains 2 lbs. of dissolved castile soap. The feathers are thoroughly handled for one-quarter of an hour, and then taken out. They are next brought into a fresh bath of the same temperature, but containing 3 lbs. of castile soap in solution, where they remain for one hour, being from time to time thoroughly handled. They are then taken out and, to remove the soap, are worked through two baths of  $100^{\circ}$  F., each containing 1 lb. of soda. They are then twice rinsed in cold water.

They are next brought into a warm water-bath to which 3 lbs. of peroxide of hydrogen have been added. In this bath the feathers remain for one hour, when they are taken out and brought into a bath of  $120^{\circ}$  F., to which 1 lb. of potassium bisulphide has been added. They remain in this bath for one hour, when they are brought into a fresh warm bath acidulated with sulphuric acid. They are then rinsed in a cold bath and next blued, according to sample, in a bath to which best Aniline Violet 6B, dissolved in alcohol, has been added. They are then passed through the extractor and dried.

Pale Blue, Navy Blue, or a redder number of Violet may also be used for bluing. The reddish tinge of the blue depends on the white; the yellower the latter, the redder the blue must be. The blue must be dissolved

in alcohol, since, if dissolved in water, small blue spots are formed in cold bluing.

5. *Dyeing black.* a. *Chicken feathers, turkey feathers, pigeon feathers, goose and duck feathers.* This class of feathers is dyed to advantage with the acid colors, using from 15 to 20 per cent. of Acid Black, according to the strength of the dye. Different grades of Acid Blacks are sold under the name of Feather Blacks. Dye the feathers at the boil with the addition of from 2 to 8 per cent. of sulphuric acid, 168° Tw., and from 10 to 20 per cent. of Glauber's salt crystals, according to the depth of the shade desired. The dyeing must be continued until the bath is exhausted and the shades are sufficiently level, *i. e.*, the feathers will have to be boiled in the dyebath about one hour. When the feathers are dyed, rinse them well, dry in the tumbler or the dryroom, and steam if necessary. Before commencing the dyeing operation the feathers should be well cleaned. For this purpose it is advisable to use a weak, lukewarm solution of olive oil soap, to which a small amount of ammonia has been added. Some Tetrapol may also be added to the solution. After cleaning the feathers, rinse them well and dye as described above.

b. *Peacock feathers.* The treatment is the same as for ostrich feathers, but the feathers must be freed from their natural bronze by treating them according to the directions given under "Dyeing ostrich feathers, 3."

c. *Parrot feathers.* Treat the same as given for turkey feathers, but first remove the natural bronze,

according to the directions given under 3. The temperature of the baths should not exceed  $167^{\circ}$  F.

*d. Skins of kingfishers and magpies.* Treat the skins in a concentrated bath of good white soap and then rinse in several warm waters. They are then placed for one hour in a strong chlorine bath of  $100^{\circ}$  F., prepared according to directions given under "Dyeing ostrich feathers, 5." They are then rinsed twice in cold water and next brought into a strong logwood bath of  $100^{\circ}$  F., where they remain for two hours. Then, without rinsing, they are placed for half an hour in a bath of medium-strong potash solution heated to  $100^{\circ}$  F. Next rinse thoroughly and return them to the logwood bath for one hour. Then rinse thoroughly, draw them through a good soap-bath, rinse again, and finally treat with chlorine.

*e. All kinds of birds' wings, skins, heads, and tails.* Wash according to directions given under cleaning. Dye as given under 5, but the temperature of the bath should not exceed  $167^{\circ}$  F.

6. *Ombré.* The same directions as given for ostrich feathers also apply here, but for fancy feathers two colors are, as a rule, only demanded. As regards the variation in the treatment of fancy articles from ostrich feathers, the reader is referred to the section, "Treatment in General."

7. *Changeant.* Parrots, as well as other birds and wings, are decolorized according to directions given under "Dyeing ostrich feathers, 2." They acquire a beautiful changeant if dyed cream-color (see ostrich feathers, 7), and dried at rest. Next prepare a neutral

bath of  $122^{\circ}$  F., with very little Eosine, and in this bath handle the cream-color dyed wings, etc., without previous wetting, for a short time. The dry articles become only partially wet in the Eosine bath, the wetted portions acquiring a salmon color, while those not wetted remain cream-color.

A beautiful contrast is also obtained with decolorized lark wings, as well as other wings, etc., which have been dyed Acid Orange, and dried. By drawing such articles through a solution of Brilliant Green, the wetted portions acquire an olive color, while the non-wetted portions remain Acid Orange.

*Drying.* The difference in the construction of ostrich and fancy feathers necessitates different methods of drying.

Ostrich feathers, after dyeing, are passed through a small bath of cold water, to which a considerable quantity of raw starch has been added, two handfuls of starch being taken for 3 quarts of water and 1 lb. of feathers. The feathers after being thoroughly rubbed in this starch water are squeezed out and passed through the extractor. The separate bunches after being somewhat beaten are hung over a line. A special frame in the form of a very broad ladder, secured by long ropes to the ceiling, is also used for this purpose. In summer the feathers may be dried in the open air, otherwise a special room which can be heated to  $122^{\circ}$  F. is required. In the open air they are allowed to hang quietly, it being only necessary to beat them occasionally either between the hands or over the edge of a table. But when drying in a

room with no natural motion of the air, the latter must be artificially produced. This is effected by tying the lines upon which the feathers are hung somewhat slack and swinging them, or the above-mentioned frame, to and fro, occasionally beating or shaking the feathers, which may finally be hung up in warm air for one day.

When a large number of feathers are to be handled, a machine, especially constructed for the purpose, can be used for working the dry starch into the wet feathers, and another machine is employed for drying off the feathers and shaking out the starch. The latter machine consists of a woven-wire cage which oscillates in a current of hot air, the starch being collected in a receptacle at the bottom. The ordinary drying tumbler may also be used for drying purposes. When drying loose feathers, wire screen is inserted around the inside of the cylinder. This prevents loss of feathers and facilitates cleaning of the machine. Feathers that are dried in the tumbler without the aid of heat present a much better appearance than when heat is used.

Feathers are curled in the following manner: They are first steamed to soften them, this being done with steam as free from water as possible, which can be secured by having a fairly capacious kettle built with the spout passing out of the top with a broad base, the kettle not being more than half-full, and the spout placed upon the top, so that the steam is as dry as it is possible to get it. The curling is effected by drawing the flues of the feather over the back of the knife, which has a curved blade, and the curl is fixed by

drying the feather before a fire. A little practice will soon make a proficient curler.

A special tool, Figs. 23 and 24, has been patented. It is formed from sheet-metal and mounted in a haft. The upper end of it is curved upward, and has a blunt edge, and is concave to accommodate the ball of the

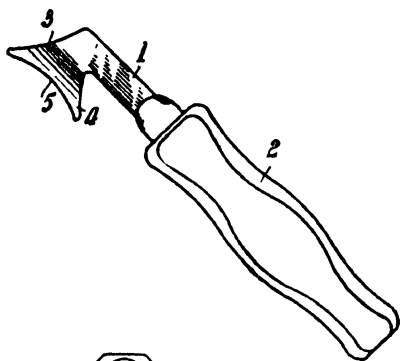


Fig. 23.



Fig. 24.

thumb. By gripping the haft the lateral projection naturally comes into line with the top point of the thumb, and by placing the feather fronds in the position against the edge and stroking upwards in the usual way, an even and regular curl is imparted to the edges of the feather, without risk of snapping or breaking. Moreover, as the thumb pressure is practically even at all parts of the knife edge, the operation of curling is hastened, and many fronds can be so treated at once. Fig. 23 is a perspective view of the tool, and Fig.



24 an end view. The knife shank 1 is secured in the haft 2, the shank 1 is formed with a lateral and extension 3, that terminates in a blade 4, formed with a concave edge 5 to accommodate the curve of the ball of the thumb, and slightly sharpened on its upper side. The blade extension 3 is curved away from the shank 1, as shown in Fig. 24, until the edge 5 is approximately at right angles to the plane of the shank, and is thereby brought into line with the natural posture of the thumb ball when the haft is held in the hand.

In operation the haft is grasped by the operator, who with the free hand passes the feather fronds to be curled between the blade edge 5, and the thumb, the blade being gently drawn from the quill to the extremity of the frond. This operation is repeated until the desired state of curliness is obtained. In practice several fronds can be curled at a time quite as efficiently as a single frond, and there is no risk of cutting or breaking the feather.

Articles of fancy feathers should not be drawn through starch-water, but after rinsing be passed through an extractor.

## VII.

### CLEANING AND RENOVATING FELT, STRAW, AND PANAMA HATS; BLEACHING AND DYEING STRAW AND STRAW HATS.

Most of the processes and formulas here given for cleaning and renovating felt and straw hats have been contributed by Mr. Nicholas J. Mergen, an expert cleaner, who has been successfully engaged in the business for many years. These processes and formulas will no doubt prove of great value and assistance to those engaged in this branch of the cleaning business. The instructions for executing the various operations are concise, readily understood by any one, and are thoroughly reliable.

*Tools.* The tools required consist of: 1 Set Board; 1 Set Round Derby Blocks, 5 inches deep; 1 Set Flat Top Soft Hat Blocks,  $5\frac{3}{4}$  inches deep; 1 Set Telescope Blocks,  $3\frac{7}{8}$  inches deep; 3 Flanges, 3-inch brim, sizes  $6\frac{3}{4}$ , 7, and  $7\frac{1}{4}$ ; 3 Pocket Flanges, sizes  $6\frac{1}{4}$ , 7, and  $7\frac{1}{4}$ ; 1 Flat Tolliker, wood; 1 Foot Tolliker, wood; 1 Combination Dorsey and Round Shackle; 3 Band Blocks, sizes  $6\frac{3}{4}$ , 7, and  $7\frac{1}{4}$ .

It is not necessary to get a full set of flanges of each shape, as with a little judgment you can make

three of each shape do the work of a full set. The same rule applies to blocks; for instance, two sizes,  $6\frac{5}{8}$  and 7, of telescope blocks are enough for general use.



Fig. 25.

Figs. 25 to 41 illustrate some of the principal tools and forms used in the cleaning and blocking of hats, and can be obtained from any of the large manu-

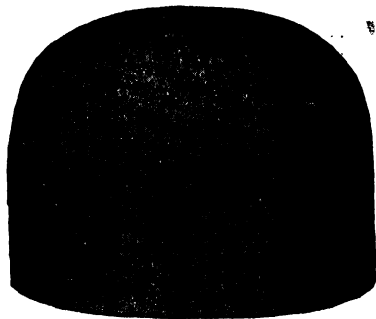


Fig. 26.

facturers and dealers in hatters' tools and supplies. Fig. 25 represents an electric clutch attached to a

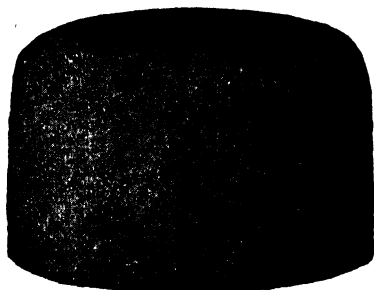


Fig. 27.

motor. It is used for cleaning derbys, and soft and straw hats, and by renovators for drying straw hats, it being almost indispensable for this purpose especially

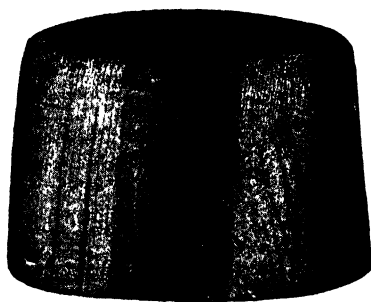


Fig. 28.

when working on a large scale, when quick drying is required.

Fig. 26 shows a block for a round-crown soft hat,  $5\frac{3}{4}$  inches deep; Fig. 27 a block for a soft hat 5

inches deep; and Fig. 28 a block for a square-crown Panama hat.



Fig. 29.

Fig. 29 shows a flange, brim  $2\frac{3}{8}$  inches, and Fig. 30 a flange for a Panama hat, brim 3 inches.

Fig. 31 is a flange stand.



Fig. 30.

Fig. 32 is a curling board, and Fig. 33 a combination curling shackle making a variety of widths and styles of curls.



Fig. 31.

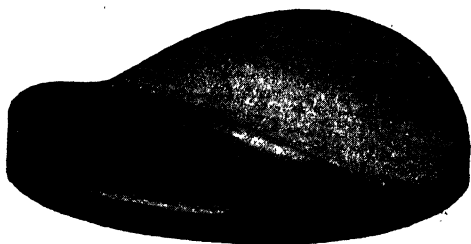


Fig. 32.

Fig. 34 shows a tolliker with nickel or brass head.

Tollikers are also made of boxwood, all brass, and all iron. Fig. 35 is a heart-shaped tolliker.

Fig. 36 represents a spring rounding jack.

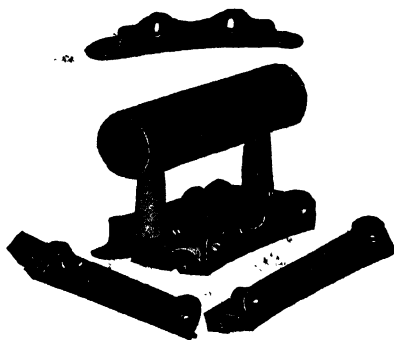


Fig. 33.



Fig. 34.



Fig. 35.

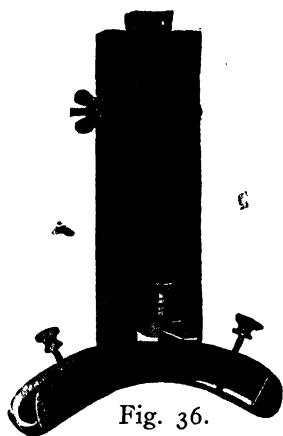


Fig. 36.



Fig. 38.



Fig. 37.

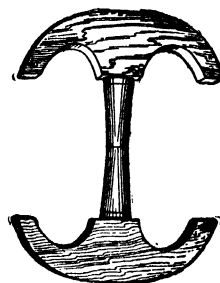


Fig. 39.

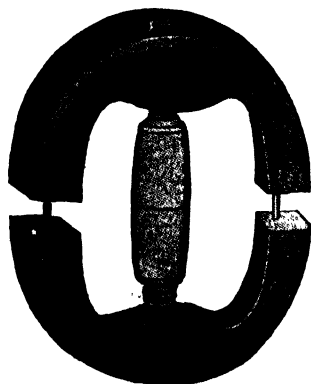


Fig. 40.

Fig. 37 shows a spinner; Fig. 38 a band block; Fig. 39 a set stick; Fig. 40 a wooden stretch block, and Fig. 41 hatters' irons.

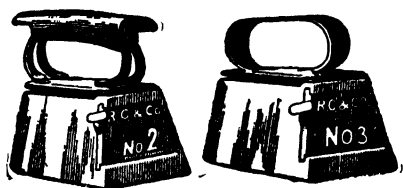


Fig. 41.

*Cleaning felt hats.*—Dry the hat and brush thoroughly to remove all dust, then soak it in a pan of gasoline or benzine for a few moments, next scrub it thoroughly with a stiff brush dipped in a benzine soap solution, and then hang it out in the air to dry. If the gasoline or benzine becomes very dirty, it is advisable to rinse the hat in clean gasoline or benzine. After drying, the hat is ready for blocking. If the hat is faded it should be pounced with No. 00 pouncing paper to remove all the faded parts and rain spots. Great care must be taken not to pounce too deep, as otherwise you will bring out dark spots, or, in other words, the body of the hat. The proper way of pouncing will be described later on.

Some cleaners still advocate the older method of cleaning hats with pipe-clay, it being claimed that by this means the dirt and grease are thoroughly removed without in the least affecting the fiber and stiffening of the hat. The process is as follows: Cover the entire hat with a paste of pipe-clay softened



in water, and allow it to dry near a stove or in a drying chamber, the temperature of which, however, should not exceed 122° F. Dark spots noticed after drying indicate that the grease beneath them has not been entirely extracted. Cover such spots again with pipe-clay paste, allow to dry and, if required, repeat the operation several times. The hats are then placed in cold water for about 12 hours and thoroughly washed, when they are ready for further treatment.

*Blocking soft or stiff hats.* Put the hat firmly on the block, have convenient an iron tea-kettle about half full of water kept boiling to make steam. Hold the hat over the steam until it becomes soft and pliable, which will require about two minutes. Then work the hat down on the block until you have it smooth and in the desired shape. Repeat steaming, if necessary, let the hat cool off for a few minutes, and then remove it from the block. The hat is now ready for setting and shaping the brim, which is done on the set board or flange, according to the shape desired.

Long-nap felt hats, including beavers, velours, etc., are cleaned in the same general manner as outlined above, with the exception that the pouncing operation, which would remove the nap, is omitted. If the French-chalk method of cleaning is used, the chalk should be rinsed out with benzine. White beaver hats are dusted with talcum after being cleaned and dried, the excess of talcum being brushed out.

It sometimes is necessary to size a felt hat. A sizing used by manufacturers is made as follows: 4 ozs. of shellac and 4 ozs. of borax are dissolved in

1 gallon of boiling water. After boiling for some time the mixture is cooled off and the scum and sediment removed. The remaining clear liquid is used for sizing purposes. The hat either may be immersed in the liquid or the size may be applied lightly with a brush.

Derby hats, as a rule, are cleaned by brushing them with clear benzine or with a solution of benzine soap. When clean they are rinsed, dried, and finished. If rain spots remain a steaming will be necessary to remove them. It is very seldom necessary to resize derby hats, but occasionally one will be received that must undergo this treatment. A sizing for these hats may be prepared from shellac dissolved in alcohol. The hat is immersed in the solution and passed through a soda-bath.

*Setting soft or stiff hats.* Steam the brim of the hat until it becomes soft and pliable enough to work, then put it on the set board and set the brim according to the height desired. Work the brim against the set board with the thumbs, until it becomes cool and set, which will require about a minute or two; then proceed with the other side of the brim in the same manner.

*Curling soft and stiff hats.* Have the curling shackle hot, using your own judgment as to the amount of heat required, according to the hat to be curled. Wet both the upper and under edge of the brim according to the depth of the curl required. Take the shackle in the right hand and work to the left, starting in the center of the front and working to the center of the back of the hat. For stiff hats run the back

of the shackle a few times over the brim after it has been wetted, to soften the brim; then proceed as above. If the curl is to be smaller in the front and rear, run the shackle outward; then use the front and rear tolliker—the one with the groove—to work down the edge of the curl. The hat is now ready for setting on the set board.

*Pouncing or finishing a soft or stiff hat.* Cut a sheet of pouncing paper into four parts. Take the paper in your right hand, one corner of it between the thumb and forefinger, and the other corner between the third and fourth fingers. Have the hat firmly on the block, and rub to the right, taking great care not to pounce too deep. Take off as much fur as you desire, but take it off evenly; then block the hat, and finish off with a hat-luering pad. Polish to the right.

*Luering or polishing soft and stiff hats.* Have a pad made of light canvas, about  $3\frac{1}{2}$  x 6 inches, and cut a slit in the end for the index finger. It is best to have two pads, one for light, and one for dark, colors. For dark colors, use crude oil; for light colors, cocoanut oil.

Rub the oil into the pad and heat it on a plate of iron placed on a gas or coal stove. Take the hat (on the block) in the left hand, and work from right to left, starting in the center of the crown. Care must be taken not to have the pad too oily, or you will get a very greasy-looking polish. In luering the brim also work from right to left.

*Flanging soft or Panama hats.* Set the hat in the

flange of the desired shape, place the band block in the hat to hold it firmly to the flange, put a piece of light canvas over the flange and tie it down by putting a blocking cord over the canvas and around the flange. Pull the canvas down until there are no wrinkles, dampen the canvas with a wet sponge, and iron until the canvas is dry. A No. 2 hatters' iron is the best size for flanging. A little practice is required to determine the amount of moisture necessary for the different kinds of hats; also in properly roping the canvas down on the flange.

After letting the hat set in the flange for about fifteen minutes, it can be removed, and it is then ready for trimming. This method applies to all hats to be flanged.

*Binding soft or stiff hats.* Measure the binding by pinning one end of it to the brim of the hat (the back end of the brim). Draw it fairly tight around the brim, until both ends meet at the back; then allow about a quarter-inch over for the turn-in. Now take the binding off and sew both ends together with an over-hand stitch, allowing a quarter-inch turn-in at each end, which will make it fit tight.

To put the binding on, stick a pin through the binding and brim at the back, then pull the binding over the brim and taper it so that the front and rear of the brim width of the binding must be the same at the center and tapered to the curl, so that there will be one-eighth inch turn over the curl. Get the binding even all around and it is then ready for sewing, which is done with No. 40 cotton. Use a small

stitch in the front and rear, and on the sides you can make the stitches about an inch apart.

The above directions are for plain binding. For reversed binding, the measuring and sewing together are done in the same way, but in putting it on, the under edge is sewed on first about one-eighth inch from the edge of the brim, and then reversed or pulled over, and then sewed on the under edge of the brim with a fine stitch, so that it does not show on the top of the brim; for this work a good strong No. 60 cotton is best.

To stitch the under binding, take one stitch through the binding and brim; then run the stitch along the extreme edge of the binding for an inch, next take another stitch through the binding and brim, and so on till finished.

*Measuring sweat leathers for soft, stiff, Panama and straw hats.* Cut one end of the leather off straight or at a very straight angle, then hold or pin it to the center of the back of the hat, bring the other end of the leather around the edge of the hat until both ends meet, and cut off the end the same as the other.

Inside of the stitched edging running the full length of the leather, you will find a reed. Pull this out about one inch, then stretch the edge of the leather, which has become puckered by pulling out the reed, until it has a slight curve. Then measure again and cut off, if necessary, the end from which the reed has not been pulled. Now push the part of the reed that is sticking out, into the other end of the leather; paste on a sticker to hold both ends together, and sew on a

small bow. The leather is now fitted and ready to sew in the hat, which is done by stitching with a small stitch about one inch apart, the long stitch being buried between the edge of the leather and the edge of the hat. Soft-hat bindings are sewed on by an ordinary sewing machine; derby bindings are all sewed on by hand.

*Formula for cleaning straw, Panama, and Leghorn hats.* Dissolve eight ounces of binoxalate of potassium in one gallon of hot water (it will dissolve quicker if pulverized), and add one-half pound of flowers of sulphur to the solution, which can be used hot or cold. Then scrub the hat thoroughly with this solution, taking care not to injure the straw or Panama. Have a box of dry flowers of sulphur into which occasionally dip the brush, as the grit of the sulphur will help to cut the dirt. After you have the hat thoroughly cleaned, rinse well in running water, and then hang it out in the sun to dry and bleach. The same method applies to Panama hats as to the cleaning, but after you have the Panama thoroughly cleaned and rinsed, dip your brush into clear water, then into your box of dry sulphur, and apply it to the Panama, so as to form a paste. See that every part of the hat is covered except the inside. Then put the hat out into the sun to bleach for an hour or so, turning it once or twice, so that the sun reaches every part of it. After the hat is thoroughly dry, take a stiff brush, and brush off the sulphur well. The hat is now ready for blocking.

The same method of bleaching can be applied to straw hats, if they do not clean as nicely as they should.

*Another excellent method for cleaning and bleaching Panama hats is as follows:* Soak the hats in a cold, fatty soap-bath to which has been added 1 teaspoonful of Burmol and 1 teaspoonful of soda to each 10 gallons of water. The hats should be soaked for 10 or 15 minutes, after which they should be removed and scoured with a stiff brush, rinsed twice in warm water and once in cold. It is essential that all of the soap be removed from the hats, and to this end they should be allowed to stand in clear, cold water for the necessary time after being scoured. A bleaching-bath is then prepared by adding 1 teaspoonful of sodium perborate to each 3 gallons of water. This bath is heated to 100° F., the hats entered and the bath kept at this temperature for 2 or 3 hours. Care should be taken to keep the hats below the surface of the bath while they are bleaching. When taken out, the hats, without rinsing, are placed in a warm, dilute oxalic-acid bath. The amount of acid used in this bath should only be enough to make the bath sour to the taste. The hats then should be given one or two warm rinses and one cold rinse, after which they are ready for sizing. Potato starch is a very good size for Panama hats, or if the cleaner desires he may purchase a prepared sizing material from the supply houses. If the starch is used it should be squeezed through the hats and the hats wiped off with muslin. The hats should be dried in the sun if possible. They never should be placed in the extractor, as injury is very sure to result.

If the cleaner so desires he may bleach the hats

with permanganate after cleaning them with soap and rinsing as described above. A strong solution of the permanganate of potash should be made, the hats entered into it and allowed to remain from 5 to 10 minutes, after which they should be taken out and rinsed in clear water. A bleach-bath, in the proportion of 1 oz. of sodium perborate to each gallon of water, and enough acid to make the bath weakly acid, is then made up and heated to 120° F. The hats are placed in this bath and allowed to remain there until they are a perfect white. They are then placed in a dilute, hot oxalic-acid bath for a few minutes. A small amount of formyl blue or cyanole added to this last bath will improve the color and produce a more pleasing whiteness. The hats are then ready for sizing and blocking.

*Another formula for cleaning straw hats is as follows:* Mix bisulphate of soda, 10 ozs.; pulverized tartaric acid, 2 ozs.; and pulverized borax, 1 oz. Make some of this mixture with a sufficient quantity of water into a thin paste, and with the latter rub or brush the hat. The tartaric acid liberates the sulphurous acid, and the borax promotes penetration into the straw fiber.

*Bleaching straw and straw hats.* The process of bleaching is much simplified by using, in place of chloride of lime or sulphurous acid, a salt containing sulphurous acid, such as sulphite or hyposulphite of sodium, etc. Dissolve a sufficient quantity of such a salt in water and immerse the previously cleaned straw articles, while still moist, in the solution, allow-



ing them to remain in it for several hours. In the meanwhile, prepare in another vessel a dilute solution of hydrochloric acid free from iron (one of tartaric acid is preferable), bring the hats into the solution, and after covering the vessel with a lid allow them to stand until they have acquired the proper degree of whiteness.

If the hats and other articles of straw are properly prepared by treatment with soap, potash, and ammonia, they will come from the bleaching fluid in a faultless state. They are then rinsed in running water, and to increase still further their whiteness they may be slightly blued with methyl-violet of a reddish tinge.

For six hats of the ordinary kind,  $3\frac{1}{2}$  ozs. of hyposulphite of sodium and  $2\frac{3}{4}$  to 3 ozs. of pure hydrochloric acid free from iron are generally required. Exact quantities by weight cannot be given, since the variety of straw, thickness of the braid, etc., have to be considered.

Hydrogen peroxide, as well as sodium peroxide, is at present frequently employed for bleaching straw, the latter being placed in a moist state in the bleaching liquor. With hydrogen peroxide the bleaching bath is prepared by adding ammonia to commercial (10 per cent.) hydrogen peroxide until red litmus paper just turns blue; the bath should be slightly alkaline, though an excess of ammonia must be carefully avoided, it having an injurious effect upon many articles. The straw remains immersed in the bath for 12 hours, and is then washed. A repetition of the process may sometimes be necessary.

For bleaching with sodium peroxide, boil the straw in a solution of about 2 per cent. sodium peroxide, rinse it in acidulated water, pass it through a bath of sodium bisulphite and finally wash thoroughly with water, and dry.

*Dyeing straw and straw hats.* The most beautiful colors on straw and straw hats are obtained with aniline colors, but the straw must first be freed from grease and bleached.

The aniline colors are best dissolved by pouring 100 parts of boiling water over 1 part of coloring matter and stirring thoroughly. The aqueous solutions being in time subject to decomposition, it is advisable to prepare only sufficient for present use and, before dyeing, filter the solutions through a close cloth, since any undissolved particles of coloring matter may readily cause stains.

For dyeing straw and straw plaiting the following dyestuffs may be used:

*a. Basic colors*, particularly for bright tones, mode shades, and blacks on material easy to penetrate.

*b. Acid colors* on material difficult to dye through.

*c. Direct colors*, particularly for blacks.

The manner in which the basic colors are dyed on straw is as follows, assuming that a light green is desired: The wetted material, while still hot, is entered into the lukewarm dye-bath and dyed at the simmer. The dye-bath is made up as follows: From 2 to 5 per cent. of acetic acid, or one-half the amount of tartaric acid (the latter gives brighter shades), 1.5 per cent. true phosphine, 5 per cent. Malachite Green

Crystals or powder. The dyeing is continued until the straw has been penetrated sufficiently. This will take about  $\frac{1}{3}$  hour on an average. The straw is then allowed to remain in the cooling-bath for about one hour longer, and when dyeing dark shades it is the better plan to allow the material to remain in the bath overnight. When Auramine O is employed it is best not to add the dyestuff to the bath until the boiling has been completed.

*Manner of dyeing straw with the acid colors. Violet.* Dye at from 175 to 195° F. for from 3 to 4 hours, or in the case of the harder plaits for from 5 to 6 hours, using a concentrated solution of Acid Violet S<sub>4</sub>B, but without any other ingredients. The water used with which to make up the dye-bath should be soft.

*Manner in which straw is dyed with the direct colors. Black.* Dye with the addition of 8 per cent. Direct Black Concentrated in exactly the same manner as explained under *b*.

The following general rules may well be observed when dyeing with the basic colors:

1. Light shades require a larger quantity of acetic or tartaric acid in the dye-bath than dark shades.
2. It is well to add the dyestuff in several portions at intervals. The acetic or the tartaric acid on the other hand, is added to the bath all at once at the beginning of the operation.
3. When dyeing in copper kettles it is recommended, especially when dyeing light shades, that  $\frac{1}{4}$  oz. of ammonium sulphcyanide be added for each 10 gallons of the dye-bath. This should be done at the commencement of the dyeing operation.

## VIII.

### CLEANING AND DYEING GLOVES.

GLOVE cleaning is done largely by hand in the small establishments, but in recent years glove-cleaning machines have been introduced to reduce the manual labor as far as possible, and are now in almost universal use in power-operated cleaning plants. It should be borne in mind that the majority of white gloves now worn are alum-tanned; and as this tannage is very soluble in water, the use of the latter or liquids containing it should be avoided.

In cleaning gloves by hand, various appliances are required, such as vessels for holding the benzine, glove sticks, brushes, glove hands or trees, and cloths for rubbing. The vessels for holding the benzine should be of zinc, or tinned or galvanized iron, and each should be fitted with a tight-fitting, self-closing lid. Satisfactory results are obtained with a rectangular vessel constructed with a lid fitted with a chain of such length that the lid will not open so far as to remain open when the hand is removed. By this means the loss of benzine by evaporation is minimized, and with it the risk of fire.

The glove stick consists of a round, tapered stick

of hard wood, and about 18 inches in length. The smaller end takes the finger of the glove, and the degree of taper is such that the wrist is on the thicker portion, which is about  $1\frac{1}{2}$  inches in diameter. Glove sticks are also made with a small rounded end to take the finger, and a broader flat portion to take the wrist.

The brushes should be of the best black bristle fastened into the back with strings. The use of wired brushes should be avoided as the bristles are cut through and readily come out.

Glove hands or trees for shaping the gloves are made of metal and are heated by steam or electricity, with four pieces to take the fingers, the thumb being shaped by the operator. It is general to employ glove hands with slots between the fingers to accommodate nickel slides which fold the sides of the fingers into the slots, shaping the gloves in the same manner as new ones.

In cleaning gloves, the kind of glove, whether kid, Suède, chamois, or buckskin, has to be taken into consideration. The last three varieties may be cleaned by putting them on the hand or a glove tree and rubbing them with bread crumbs or a stiff brush dipped in a mixture of dry fuller's earth and powdered alum.

*Cleaning kid gloves.* It is not a difficult matter to get satisfactory results when cleaning kid gloves; in fact, these articles of dress are easily handled and can be made to provide a considerable revenue to the cleaner, in season. The first step when handling gloves should be to sort them according to color and to clean each lot separately. Three main separations may be

made—white, tan, and black. Further, white gloves with black stitching should be cleaned separately, owing to the fact that the black dye with which the stitching is colored sometimes bleeds, in which case it would discolor all of the other gloves that might be in the lot. If the cleaner has a large volume of gloves to handle, it is a further advantage to further sub-divide them into two classes—those badly soiled and those but slightly soiled. In the former subdivision should be placed those that are badly stained with perspiration. These may be soaked with advantage for an hour in a bath prepared with 5 pints of benzine,  $\frac{1}{8}$  pint of ammonia, 1 pint of wood alcohol, and 1 oz. of benzine soap. At the end of the soaking period, the fingers, if stained so badly as to make such a treatment necessary, should be given a scrubbing with a brush dipped in the soaking solution. Not all gloves will require this scrubbing. This method of treating perspiration stains is best done before the gloves are put in the cleaning-bath, but it may be done after cleaning if desired. Ether and chloroform are also used for removing perspiration stains from gloves, but they give no better results than the solution described above. If any stains resist this treatment they may be further treated by rubbing them with a soft cloth dipped in alcohol and working the stained portions between the fingers.

When the perspiration stains have been removed the gloves are ready for cleaning. Gloves that are to be cleaned by hand are placed on a glove stick or laid flat on a slab, and scrubbed with a concentrated solu-

tion of benzine soap. Settled benzine may be used for tan and black gloves, but only distilled solvent should be used for white and light-colored ones. When the gloves are clean they must be given several rinses to remove the soap. This stage of the process must be done thoroughly. If any soap is left in the gloves it will cause them to have a bad odor and in addition will give them a yellow cast.

When all of the soap has been removed, the gloves should be wrapped in a cloth and extracted lightly. They then should have talcum powder, colored to correspond with the particular gloves, rubbed into them, expanded, and hung to dry. If a talcum powder corresponding in color to any particular pair of gloves cannot be had, white powder may be colored to the desired shade with a basic dye. When the gloves are dry they are rubbed with a cloth to remove the surplus powder, and shaped and polished on a heated glove form. The polishing is done by rubbing the gloves while on the hot form with a soft cloth. The more rubbing the gloves get at this time the higher the polish will be.

*White gloves* that have a yellow cast after being cleaned in this manner should be blued in the last rinse. For this purpose some blue dye soluble in benzine should be used. Also the yellow cast may be corrected by tinting white talcum powder blue and rubbing the powder into the gloves, but the result will not be as permanent nor as satisfactory as that had by bluing.

*Colored gloves* are cleaned in the same general man-

ner as outlined above, with the exception that less soap is used in the cleaning-bath. All of the processes necessary to clean colored gloves should be hurried as much as is possible, consistent with good results, to prevent undue loss of coloring matter. Some lightening of the shade is always bound to occur when colored gloves are cleaned and cannot be prevented. After the gloves are cleaned and extracted, the color may be restored by rubbing the gloves with talcum powder colored to the desired shade, or by treating them with an oil-soluble color. The color to be applied should be dissolved in benzine and applied with a soft cloth, using care to see that it is put on evenly.

Inasmuch as the dry cleaning dissolves out some of the fat in the leather, some cleaners and dyers deem it advisable to soften them again. This is done by passing the white gloves through a bath made up of 2 ozs. of lanolin and 3 ozs. of white petrolatum dissolved in 3 gallons of benzine. The softening-bath for black gloves is the same except that amber petrolatum is used in place of white. The gloves are left in the bath for from 10 to 15 minutes, extracted, and dried.

Another method occasionally employed is to soak colored gloves in a mixture of sweet oil with 12 times its volume of benzine for about half an hour, and then to rub dry. This is certainly attended with less risk to the color, but it makes the leather hard and brittle.

The cleaner who has a large volume of gloves to clean will do well not to attempt to do the work by hand, but to use a machine for the purpose. The process, when using a machine, is the same as that out-



lined above for hand work, with the exception that the gloves are scrubbed in a concentrated benzine soap solution in the machine instead of by hand.

An excellent method of cleaning white gloves is as follows: Soak the gloves in benzine. If there are rust or ink stains they are removed before soaking. To remove rust stains, damp them with a wet, pointed stick, and then pat them with a cloth dipped in dilute oxalic acid. As soon as the stain has disappeared, rinse the place and dry it with a white cloth. The treatment must be executed as quickly as possible and the wetting must be confined to the stained part. It is also essential to remove the acid completely the moment it has done its work. Ink stains are treated in the same way, but as much of the ink as possible should be removed by rubbing with a damp cloth. The soaking and washing should be done in a dry, warm room, which must not be heated by steam, or have steam escaping in it. After a brief soaking, each glove is wrung, put on a glove form and carefully brushed all over with a hard brush which resembles a large tooth-brush. During the process the brush is dipped alternately in alcohol and in zinc white. The two make a paste on the brush which penetrates the pores of the leather and brings away all dirt and perspiration. Places stiffened by perspiration, such as the finger-tips and the part of the glove covering the ball of the thumb, are specially treated afterwards by rubbing them, using the forefinger and thumb of each hand. This treatment effects a radical cure, and the places become soft and white again.

The gloves are then rinsed in clean benzine. This is then squeezed out, and the leather is nourished with a fat-bath for about half an hour. The benzine makes the leather brittle, and benzine soap acts far more vigorously in the same direction, so that its use should be avoided. The fat-bath is made by dissolving 2 lbs. of lanolin and 4 lbs. of vaseline in 10 quarts of benzine over a water-bath. This is diluted for use with 10 times its volume of benzine. Oils must not be used, as they turn rancid and impart a bad odor to the leather. The bath in use is kept in a vessel with a tight-fitting lid, and is reinforced from the stock solution as required. Care must be taken that the sediment from the stock solution does not get into the bath. When a fresh stock is made the benzine is distilled off from the sediment from the old solution.

After about half an hour in the fat-bath the gloves are taken out one by one and well squeezed. They are then at once dusted over with powdered talcum, unless there are still dirty spots which must first be rubbed with zinc white on the glove form by means of a medium-hard brush. All this and the powdering with talcum must also be done on the glove form before the glove is dry. Then put it on a stretcher and polish it by hard rubbing with a clean white linen cloth. The talcum is applied with a linen rag rolled up and tied at the ends of the roll, and dipped into a box of the powder.

*Chamois gloves* are washed in lukewarm soap-water  
\* to which a few drops of ammonia have been added.

Soak the gloves in the bath for some time, and promote the loosening of the dirt by squeezing and kneading. Then rinse in clean water, and draw the gloves through a weak soap-bath to keep them soft after drying. This treatment restores "nourishment" to the leather. The soap-bath should, however, not be too strong, otherwise the leather becomes smeary. The gloves are then thoroughly wrung and rubbed between the hands, so that the water still remaining in them is uniformly distributed in order to prevent stains from wringing. They are then drawn smooth, stretched with the glove stretcher, and dried in the air, but not in the sun, nor at too high a temperature. Wringing should not be done lengthwise, but in the direction of the width; place the fingers over the palm of the glove.

Colored chamois gloves have to be re-dyed after washing, they losing much of their dye during the process.

After dyeing, the smoothness and the softness of the leather must be restored. This may be done by taking the gloves through a softening-bath which is prepared as follows: Two ounces of pure castile soap;  $\frac{3}{4}$  oz. of bleached wax;  $\frac{1}{2}$  oz. of glycerine;  $\frac{1}{2}$  oz. of sodium perborate dissolved in cold water; the yolk of one egg, and a few teaspoonfuls of Monopol oil. Mix these ingredients together well and add enough water to make a thin liquid. Work the gloves in this preparation until the leather has become soft, then squeeze them out, wrap them in a cloth and give them just enough extracting to remove the surplus water. It •

should not be forgotten to work the gloves well in the preparation. The gloves then should be dried in a cool, well-ventilated place. If they are placed in a hot dry-room they become streaked and the dyeing must be done over. When dry they are finished on forms.

*Buckskin gloves* are soaked in lukewarm water for half an hour previous to washing. Then wash them in a soap solution at 77° F., paying special attention to the seams, as the dirt sticks very firmly in them. Then rinse the gloves thoroughly, wrap them in a dry linen cloth and extract, and finally hang up to dry. When an extractor is not available wring them as dry as possible in a linen cloth. To restore flexibility and softness to the gloves, add to the last rinsing water glycerine in the proportion of two teaspoonfuls to the quart of water.

*Gauntlets* are cleaned with benzine, or, in case they are very dirty, with soap, and then rubbed with talcum. If the cuffs are tinted, pulverize very pure whitelead (krems), stir with dissolved gum-arabic and water (half and half) to a thin paste, and apply it with a brush to the cuffs. After drying, rub vigorously with a white cloth to restore the luster.

*Suede gloves* are cleaned as follows: Place them in a bath of ammonia 2 parts, water 8 parts, for two days, then rinse in cold soft water, and dry in the air. Since by this method of washing the gloves are not rubbed as is necessarily the case in washing with soap, the leather does not become rough, but preserves its original appearance.

*Silk gloves.* White silk gloves are easily cleaned in a soap-bath. The temperature of the bath should not exceed 130° F. When clean the gloves should be given one warm rinse and two cold ones, in the last of which a small amount of alcohol has been added. When the gloves are but partially dry they should be sized with a weak solution of fish glue and finished by ironing.

*Colored silk gloves* are liable to bleed considerably when wet cleaned, and, therefore, the dry-cleaning process should be used whenever possible. When wet cleaning is necessary to get colored silk gloves clean, it should be done as quickly as possible in cold or lukewarm water and the gloves rinsed in acidulated water.

Machines for cleaning gloves have come into extensive use. There are a number of different types of these machines on the market, and in principle are identical, the gloves being cleaned by revolving or reciprocating brushes in a concentrated benzine soap solution. The gloves, as a rule, are freed from perspiration stains before being placed in the machine. Glove-cleaning machines are inexpensive in first cost, and economical to operate, and they turn out a large volume of work at a low production cost. In addition the grade of work done by them is superior, in most cases, to that done by hand.

*Dyeing kid gloves.* After the gloves have been washed and powdered as previously described, the powder should not all be rubbed off, but a little of it should be allowed to remain on the leather. They are then dyed by applying a solution of the required

coloring matter with a brush or, what is better, with a flannel rag, since with a brush the coloring matter is apt to be laid on too thick and uneven.

The inner widths of the fingers should be dyed first. After the color has been applied, the gloves should be well rubbed with colored powder, then stretched on the glove tree, and the upper breadth of the hand dyed as evenly as possible, and likewise well rubbed in with powder. Last of all the inner part of the palm of the hand should be dyed and powdered. Should the color look unequal, retouch and powder once more. The powder equalizes the color of its own volition, as it is vigorously rubbed into the damp leather. After thoroughly drying, a second fat-bath of the same composition as previously given may be applied. While this is not absolutely necessary, it greatly improves the appearance of the gloves. Last of all polish.

*Black on gloves.* The most common older method of dyeing leather black is by means of logwood. Apply decoction of logwood of 3 to 5 degrees Bé., giving two or three coatings, allowing each coating to become dry before applying the next. Then dip the gloves in a solution of green vitriol and brush with warm water. Should the color not prove sufficiently dark, some decoction of fustic or quercitron may be added to the logwood decoction. In place of green vitriol, nitrate of iron may be used. As the leather begins to dry, rub it with a little olive oil and talcum powder and press between flannel. The treatment with olive oil and talcum powder is repeated, and the gloves allowed to

dry on the glove form. No coloring matter must reach the inside of the glove.

The bluish tint so much liked in black gloves is obtained by washing the dyed article with ammonia.

*Brown on gloves* may also be obtained by the application of decoctions of fustic, logwood, and Brazil wood, with some alum, the quantities of the dyestuffs to be used depending on the shade required. For darkening the shade use a small quantity of green vitriol.

*Morocco-red* on gloves is produced by applying cochineal decoction, to which a little tin salt and oxalic acid have been added. A darker shade is obtained by the addition of a small quantity of logwood decoction.

*Gray on gloves* is produced by applying sumac decoction, and subsequent treatment with weak solutions of green vitriol. An addition of fustic and logwood, as well as fustic and Indigo Carmine, to the sumac decoction gives *greenish gray*.

If the seams are to remain white, cover them with flour paste mixed with a small quantity of fat.

The use of aniline colors for dyeing kid gloves is, however, far more simple and cheaper than the previously described methods.

There are at present very few shades of colors which cannot be produced with the assistance of aniline colors, and, with the exception of very special tones, it may be asserted that even the most difficult shades can be dyed on leather.

However, not all aniline colors can be used for dyeing leather, many of them which are suitable for

silk and wool exerting a destructive influence upon leather.

The best class of dyestuffs to use are the basic coal-tar dyes like Magenta, Safranine, Phosphine, etc., they having so strong an affinity for animal tissues that leather can be colored or stained by simply applying an aqueous solution of them. Next to these in their value as dyes for leather are the azo and acid dyestuffs, but their aqueous solutions require to be acidified with some acid, best with acetic or oxalic acid.

For dyeing with aniline colors the gloves are smoothly stretched over wooden hands, and the dyestuff is applied with a brush, or better, with a flannel rag.

Ready-made dye pastes in all glove shades are sold by dealers catering to cleaners and dyers. These preparations are effective, simple of application, and they can be efficiently used to re-dye all gloves that have become faded through wear or cleaning. The gloves to be re-dyed are stretched on a heated glove form or cone, and the dye paste is applied with a soft cloth. Following are formulæ for preparing glove pastes:

Five ozs. olive-oil soap,  $2\frac{1}{2}$  ozs. cocoanut oil, 1 oz. castile soap, 1 oz. tallow, 1 oz. lard, 1 oz. bleached wax, 1 oz. sugar, 1 oz. of soluble dye of the color required well dissolved in alcohol and strained through a hair sieve. The mixture must be thoroughly heated and well mixed. Some talcum powder should be added while mixing.

Another excellent preparation made in the same way is as follows: 1 oz. gum tragacanth, 1 oz. oil of Benzol,



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a pinch of suitable coloring matter such as Leather Black, Straw Black, Golden Brown, Bismarck Brown, etc. Wintergreen oil is sometimes added to give the preparation a pleasant odor. Both of the above preparations dry rapidly when applied to the glove on the heated form.

A number of the oil dyes can also be used for dyeing gloves. Those of this class that are soluble in benzine may be added directly to the benzine-soap solution, while others may be dissolved in alcohol and applied. Some of the dyes of this class are Oil Yellow, Oil Orange, Oil Scarlet, Oil Red, Oil Brown.

## IX.

### GARMENT DYEING.

THIS branch of the dyeing trade is, of course, quite different from that of piece dyeing. Garment dyeing is the most difficult, the most troublesome, the most thankless, and often the least remunerative of all the departments of dyeing. Unlike the piece dyer, the garment dyer receives the goods he has to operate upon after they have been already dyed. These have to be re-dyed, either of the same color, because the original color has faded, or of a different color altogether. In the latter case stripping is often a necessary preliminary operation. The stripping would be easy enough, if that were all that was wanted, but the garment dyer is expected to work without injury to the material of the fabric, and to give the customer as good a result as regards color as if he were a first-hand dyer.

The first point is to keep the fabrics stretched as much as possible during the whole of the processes. Many old goods tear under the least stretching, especially those which have been long exposed to sunlight. It is, therefore, advisable with all goods to stretch them gently with the hands in the presence of the customer. If they then rend, the customer, if rea-

sonable, will be convinced that their day is over. If they do not, it will be safe to re-dye them. The practical dyer will, however, have judged by the resist of the fabric the exact strength of the fiber, and if the stuff is worth re-dyeing he must judge of the dye to be used with reference to this. He must, in case the fiber is weak, select such dyes as can be used in baths whereof neither the temperature nor the reaction is sharply marked. At the same time he has a second selection to make even among these, as regards leveling and coloring power. He has also to consider, especially when a material has to be re-dyed of the same color as at first, the degree in which the original color has suffered through wear and exposure. It may be merely lighter. It may have changed in shade. Generally it is not only altered in shade or even color, but is paler. In this matter experience alone is of service, it being impossible to give fixed rules.

If the original color is:

*White*, any color can be dyed.

*Yellow*, any color, except pink and light blue.

*Gray*, any color, except pink, pale blue, cream, and yellow.

*Lilac, pink, and prune*, to pensée, dark blue, olive-green, olive-brown, dark brown, and black.

*Pale blue*, any color, except yellow, cream, pink.

*Corn or gendarme blue*, to navy blue, dark brown, reddish-brown, corinth, medium green, dark green, olive-green, olive-brown, medium brown, black.

*Light, medium, or bluish green*, to dark green, olive-green, olive-brown, dark brown, black.

*Dark blue*, to corinth, dark green, olive-green, black.

*Olive-green or brown*, to the same color, reddish brown, dark brown, black.

*Dark or Russian-green*, to the same color, olive-green, olive-brown, reddish-brown, corinth, dark brown, black.

*Pink*, any color, except yellow, cream, and light blue.

*Carmoisine, cerise or ponceau*, to red, olive, medium brown, dark brown, dark green, black.

*Bordeaux*, to the same color, reddish-brown, corinth, dark brown, black.

*Reddish-brown*, to the same color, dark brown, black.

*Light brown*, to dark green, olive-green, olive-brown, reddish-brown, bordeaux, medium brown, dark brown, black.

*Medium brown*, to the same color or black.

*Black*, to the same color only.

#### DYEING SILKS.

Silk garments to be dyed a light color must show a white ground, or the original color should be of such a nature that it can be removed by stripping or washing, or at least a clear light tone, similar to the color to be dyed, should remain after washing. However, beautiful light colors can only be produced upon a white ground, and even then a few places may be found which by perspiration, dirt, or contact with air have acquired a different affinity for the coloring matter.

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After washing, and in dyeing the greatest care is required, and perfect cleanliness should prevail. All crumpling together of the articles should be avoided, and it is therefore advisable to let the garments remain in the last rinsing water until dyeing commences. For dyeing, copper kettles should be avoided, or, if this cannot be done, the kettle should be very wide, so that in handling the articles, they do not come too much in contact with the sides of the kettle, otherwise copper stains, or so-called *kettle stains*, may be readily formed. Another reason for the employment of a wide kettle is, that by dyeing closely together in a narrow kettle creases difficult to remove are readily formed, especially in heavy silk garments.

The goods to be dyed are generally cleaned and stripped with very weakly alkaline hot water containing soda carbonate or ammonia, or with strong boiling soap liquor containing about  $\frac{1}{2}$  lb. of soap per 10 gallons of water. Soap does not injure the silk fiber; frequently, however, silk moderately weighted has to be dyed, and in this case it tenders during the treatment. A small portion of the goods to be dyed must, therefore, be tested for strength. This is generally done by folding a small cutting of dry material in the direction of both the warp and the weft, pressing the crease hard with the finger nail or a flatiron, and trying its strength by stretching and pulling. If it breaks in the creases very great caution must be exercised in dyeing. The test is still more thorough if the material be previously boiled for some time in a soap solution.

Damage due to wear and exposure of silken material may be comparatively remedied by stripping the ground color, as the subsequent re-dyeing covers any defects. Less attention need, therefore, be paid with silk than with wool to the selection of leveling dyestuffs, and nearly any coloring matter can be employed on silk, though the acid dyestuffs are generally used, as, with a few exceptions, all of them dye silk satisfactorily. The following dyestuffs are recommended:

*Blacks.* Acid Blue Black, Acid Jet Black, the latter shaded with Indian Yellow and Acid Green.

*Blues.* Alkaline Blue, all makes, Brilliant Wool Blue G, Patent Blue Concentrated, Cyanole, Victoria Blue, Indigotine, Indulene, Acid Navy Blue, Fast Wool Blue.

The various brands of Alkaline Blues are dyed near 170° to 195° F., with the addition of from 4 to 5 per cent. of borax. After dyeing, the goods are rinsed in water and the color is "raised" in a hot bath containing a small quantity of sulphuric acid.

*Green.* Acid Green Y, Acid Green B, Wool Green.

*Orange.* Acid Orange Y.

*Reds.* Azo Rubine, Croceine, AZ, Fast Red A, Rhodamine B, Rose Bengale Extra N, Scarlet all brands, Azo Fuchsine, Azo Carmine, Ponceau.

*Violet.* Acid Violet Bluish, Acid Violet 6B.

*Yellows.* Acid Yellow R, Azo Yellow Y, Azo Yellow G, Naphtol Yellow L, Tartrazine.

For the production of deeper full tones, the acid dyestuffs may be combined with Indigo, Pensée Lake,

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etc. The silk fiber combines with these coloring matters without a mordant, it being in most cases only necessary to acidulate the dye-bath with sufficient sulphuric acid that its presence can be detected by the taste. However, acetic or formic acid may with advantage be substituted for sulphuric acid, as the better exhaustion produced by the latter is of little consequence in silk dyeing, while, on the other hand, the organic acids produce better leveling baths.

Enter the goods at about 120° F. and gradually raise the temperature to about 150° F.

All silk goods, after rinsing in water, are "scooped" in a dilute acetic acid bath to impart to them the peculiar handle or "scoop" possessed by all silk fabrics.

A few formulas for dyeing silk dresses and fabrics will here be given, but the dyer must not rely too much on the quantities given as, owing to the difficulties which are involved in a number of dresses and other fabrics, the sizes of which may vary much, it is practically impossible to give definite quantities in receipts, and the garment dyer must be prepared to vary the quantities to suit the number and size of the goods he is dealing with.

*Black on silk.* For 20 lbs. weight of goods prepare a dye-bath with 1½ lbs. Acid Blue Black, ½ oz. Azo Yellow R, 2 lbs. of Glauber's salt, and 4 ozs. of acetic acid. Different blacks especially suitable for silk goods can be had from most dealers in dyestuffs. Saddening is done with Indian Yellow or Orange.

*Dark brown on silk.* For 10 lbs. of goods prepare a bath containing 3½ ozs. of formic acid, ¾ ozs. Acid

Yellow R, 2 ozs. Azo Carmine 2B, and 1 oz. Patent Blue Concentrated. Enter the goods into this bath and work them constantly, and at the same time gradually raise the temperature to 190° F., and eventually to near the boiling-point, but don't boil the goods. Finish according to the shade desired with Acid Brown, Acid Yellow, or Acid Blue.

*Tobacco brown on silk.* For 10 lbs. of goods. Dye in a bath containing 5 ozs. of sulphuric acid, 14 ozs. of alum, 175 grains of Acid Violet Bluish, 420 grains of Acid Orange, and 105 grains of Azo Yellow. Enter the goods warm and gradually heat, with constant handling, to the boiling-point. Rinse.

*Gold on silk.* For 10 lbs. of goods. Dissolve 5 ozs. of Azo Yellow, 1 oz. of Acid Orange,  $\frac{1}{3}$  oz. of Acid Blue G, and  $5\frac{1}{2}$  ozs. of alum in the dye-bath and add  $5\frac{1}{2}$  ozs. of sulphuric acid. Dye at a temperature of from 145° to 200° F.

*Bordeaux red on silk.* For 5 lbs. of goods prepare a bath which contains the following in solution:  $4\frac{1}{4}$  ozs. of sulphuric acid,  $2\frac{1}{2}$  ozs. of Acid Fuchsine,  $1\frac{3}{4}$  ozs. of Fast Red,  $\frac{1}{2}$  oz. of Indigo Carmine. Enter the garments at 145° F. and work them for about half an hour up to boiling when they are finished.

*Scarlet on silk.* Prepare a bath containing 2 ozs. Scarlet 4R, 8 ozs. of Glauber's salt, and  $\frac{1}{2}$  oz. sulphuric acid. Dye in the boiling bath. Various shades of scarlet can be dyed by using the 2R, 3R, or OO Scarlets.

*Crimson on silk.* Prepare a bath containing 8 ozs. of Glauber's salt, 1 oz. of sulphuric acid, and 1 oz. of Azo Carmine, and dye at the boil. The shade of crim-



son thus obtained is beautiful, and is fast to washing and light.

*Cherry red on silk.* Prepare a bath with 1 oz. of sulphuric acid, 1 oz. of Acid Magenta,  $1\frac{1}{2}$  ozs. of Fast Acid Red,  $\frac{1}{2}$  oz. of indigo extract, and dye at the boil.

*Cream on silk.* Add to a soap-bath a little Phosphine, or New Phosphine G, raise the temperature to the boil, enter the goods and work for 15 minutes; then lift, wash and dry. It takes but little of any of these dyestuffs to produce a cream, and care must be taken in making the addition to the bath, otherwise the shade will be too dark.

*Rose color on silk.* Dye the garments in a neutral bath of  $122^{\circ}$  F., containing  $2\frac{1}{2}$  to 8 drachms of Fuchsine Powder. For deeper bluish reds use Acid Rubine, Fast Acid Red Conc., Carmoisine, Azo Fuchsine.

*Salmon rose on silk.* For 10 lbs. of goods prepare a bath with  $\frac{3}{4}$  oz. Azo Fuchsine SB,  $\frac{1}{4}$  oz. Fast Yellow S, 1 lb. Glauber's salt, and 2 ozs. acetic acid.

*Blue on silk.* Dissolve in a bath  $1\frac{1}{3}$  ozs. of Alkaline Blue 6B, and 8 ozs. of borax, or 10 ozs. of soda. Enter the garments, etc., at  $100^{\circ}$  F., and while thoroughly working them, heat the bath to  $167^{\circ}$  F. Then take them out and prepare a fresh cold bath, to which add  $5\frac{1}{4}$  ozs. of sulphuric acid. In this bath work the silk for  $\frac{1}{4}$  hour, take out and rinse.

*Navv blue on silk.* Greenish dark. For 10 lbs. of goods prepare a bath containing  $9\frac{1}{2}$  ozs. of Indigo-tine,  $4\frac{1}{2}$  ozs. of Acid Navy Blue,  $1\frac{1}{4}$  ozs. Acid Orange, 2 to 8 ozs. of sulphuric acid. The acid should be

added gradually while dyeing. Start the dyeing operation at  $190^{\circ}$  F. and heat up to the boiling-point. Dye until the coloring matter has been absorbed uniformly.

For pale blue and blue the following dyestuffs are useful: Cyanole and the various brands of Alkaline Blues. For peacock, navy and dark blues, the same dyestuffs may be used if shaded or darkened with Cyanole Green, Acid Green, Acid Blue Black, Acid Jet Black, according to requirements.

*Heliotrope on silk.* For 5 lbs. of goods. Dye in a bath of  $2\frac{1}{4}$  ozs. of sulphuric acid,  $5\frac{1}{2}$  drachms Acid Violet 6B, and  $8\frac{1}{4}$  drachms Acid Violet R up to  $167^{\circ}$  F. According to whether the heliotrope is to be bluish or reddish, use a larger quantity of the first or the latter coloring matter. If a dull shade is desired, add Orange or Azo Yellow.

*Prune on silk.* For 5 lbs. of goods use a bath containing  $3\frac{1}{2}$  ozs. of sulphuric acid,  $8\frac{1}{4}$  drachms of Ponceaux, and  $13\frac{1}{4}$  ozs. of Acid Violet 6B. Dye according to the directions given for heliotrope, and shade according to sample; for duller shades tone with Orange; for clear tones with Acid Fuchsine and Acid Violet.

*Silver gray on silks.* For 5 lbs. of goods. Dissolve in the bath  $1\frac{1}{2}$  ozs. of sulphuric acid,  $1\frac{1}{2}$  drachms of Acid Violet R, and  $8\frac{1}{4}$  drachms of Aniline Gray. Dye at from  $167^{\circ}$  to  $195^{\circ}$  F.

*Gray on silk.* For 5 lbs. of goods prepare a bath containing  $2\frac{1}{4}$  ozs. of sulphuric acid and  $1\frac{1}{4}$  ozs. of Aniline Gray. Dye at  $195^{\circ}$  F., and eventually shade with a little Orange or Fast Brown.

For grays the various brands of Induline, Nigrosine,

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and Aniline Gray may be used, which may be shaded as desired with Orange, Indian Yellow, or Azo Fuchsine.

*Bright green on silk.* For 5 lbs. of goods prepare a bath containing Azo Yellow,  $1\frac{1}{4}$  ozs.; Acid Green, 14 drachms; sulphuric acid,  $2\frac{1}{4}$  ozs. Dye until the green has been uniformly absorbed, and finally boil gently for a short time.

*Pea-green on silk.* For 5 lbs. of goods prepare a bath with  $\frac{3}{4}$  lb. Fast Yellow S,  $1\frac{1}{4}$  ozs. Cyanole extra,  $\frac{1}{2}$  lb. Glauber's salt, and 2 ozs. acetic acid. Work at the boil.

*Fancy colors and all other intermediate tones.* As fancy colors may be designated all tones which deviate from the regular ones. They are produced as follows: As ground colors in dyeing, red, yellow, and blue are used, they being the so-called complementary colors of which all other tones consist.

Now, according to the preponderance of one of these ground-tones in the desired color, the articles are first dyed with it and shaded with the others.

As materials for the ground-tones may be recommended for *yellow*: Azo Yellow, turmeric; for *red*: Fast Red, Ponceau, Fast Brown, and also Acid Fuchsine: for *yellow and red* together: Orange; for *blue*: Indigo Carmine, Aniline Blue, Marine Blue; for *blue and red* together: Aniline Acid Violet. For the aniline colors the bath is acidulated with sulphuric acid, and for the other coloring matters with it and alum.

*Genuine velvet* is dyed in the same dye-baths used for silk garments, but greater care is required in the treatment. Baste around the separate pieces a strip

of stuff two fingers wide, by which the velvet is worked during the entire operation. When entering the articles in the bath, place the velvet side down so that in pushing down the wrong side receives the pressure of the hand or stick. After dyeing immediately apply to the wrong side a solution of gum or gelatine and dry. As regards the rest, it is treated as cleaned velvet.

A number of the direct colors may be used to very good advantage for dyeing silk goods, principally for the production of dyeings fast to water and washing. These dyeings are made in a neutral boiled-off liquor slightly broken with acetic acid. Any excess of acid in the dye-bath should be avoided, particularly when dyeing goods that offer resistance to the penetration of the coloring matter. It is well to commence the dyeing by working without any acid, adding it, a little at a time, only when good penetration has been attained.

#### DYEING WOOL AND SILK (GLORIA) FABRICS.

Gloria is woven from the two fibers—wool and silk—of a fine texture, so that it can be used in the place of a silk fabric. It is mostly dyed with the acid dyes, and these, as a rule, dye the wool more strongly than the silk when applied at boiling heat, the converse being the case at low and medium temperatures.

The following dyes act equally on wool and silk at boiling heat: Fast Green Bluish, Patent Blue, Alkali Blue, Alkali Violet, Navy Blue B, Acid Violet 6B, all Acid Blacks. The following dyes have rather stronger

affinity for wool: Light Green S, Wool Green, the Acid Orange dyes, Ponceaus, etc.

On the basis of their affinity for silk and wool, the acid dyes may be divided into three groups, those given above as having an almost identical affinity for both fibers being taken as the first group. To the second group belong such dyes as chiefly dye wool when applied at boiling heat—*e. g.*, Tartrazine, Orange G, a few Ponceaus, Indigo Carmine Cyanine, etc. Finally the third group comprises the dyes having more affinity for silk than for wool at medium and low temperatures: Azo Carmine, Acid Violet, Water Blue, etc., as also the majority of the basic dyes such as Methyl Green, Auramine, Rhodamine, etc.

The best means of dyeing wool and silk to shade is by using the dyes of Group I, unless prevented by other reasons such as their equalizing properties, suitability for combinations, etc. The mode of application is as follows: The bath is set with about 10 per cent. of "tartar preparation," bisulphate, and one-half the necessary quantity of dye, the goods being then entered, and the bath raised to boiling heat as quickly as the equalizing properties of the dye permit, boiling being continued until the wool appears sufficiently shaded. The silk will, as a rule, be less deep in color; consequently after boiling the bath down to between 113° and 122° F., the rest of the dye is added, and the operation continued in the cooling bath until the silk has been properly dyed. If, however, this result fails to ensue, recourse must be had to a suitable dye of the third group. In this manner a

light yellow may be obtained with Azo Flavine, which, however, turns dirty in dark shades; a dark yellow and orange, with Orange II; red with Azo Carmine, Magdala Red, or a Ponceau; pale blue with Patent Blue; dark blue with Acid Violet 6BN, and a bluish fast green; black with Acid Black, bluish, deepened with Orange and a basic green at low temperature. For mode colors, use is preferably made of Azo Carmine, Patent Blue, and Azo Flavine.

To produce "shot" effects the following procedure is adopted: The wool is dyed first with a dye of the second group, at boiling heat; the small amount of dye that has become fixed on the fiber of the silk is then removed by boiling with water, soap, or ammonium acetate, and the silk afterwards dyed in a third bath containing a dye of the third group, the bath being concentrated and cold, or, at most, lukewarm. Red, for instance, is produced on the wool by the aid of Ponceau 2R, and the silk dyed green with Methyl Green and Auramine; or the wool dyed green with Acid Green extra conc., the silk red with Rhodamine, etc.

#### DYEING WOOLEN GARMENTS AND FABRICS.

The various methods that are used for dyeing wool have, of course, underlying them certain principles on which they are based, and on the observance of which much of the success of the process depends. Wool must be treated differently from cotton, since a process of dyeing which gives good results with the latter

fiber would lead to nothing but disastrous effects with wool or silk. On the other hand, processes are used in the dyeing of wool which could not be possibly used for cotton on account of the very different properties of the fiber.

Without entering too much into detail it may be said broadly that the application of the various coloring-matters to wool is governed by three principles, namely: Dyeing with acid dyestuffs, with basic dyestuffs, and dyeing with mordant dyes.

*The application of the acid dyestuffs* is effected in the presence of acids or salts, viz., sulphuric acid, sodium bisulphate, formic acid, Glauber's salt, alum, acetic acid, ammonium acetate, or ammonium oxalate. The object of these acid adjuncts is to neutralize the calcium bicarbonate in the dye water, liberate the dye acid, and finally to diminish the solubility of the latter in water, thus facilitating its absorption by the fiber and helping the bath to "draw." The stronger the acid the better and more quickly is the dye absorbed by the wool. An equally important rôle is played by Glauber's salt, which acts as regulator to ensue uniform absorption of the dye by checking the rate of absorption.

The usual method of dyeing wool with acid dyes is as follows: The bath is charged with 2 to 4 per cent. of sulphuric acid, 10 per cent. of Glauber's salt, and the solution of dyestuff, the goods being entered at a lukewarm or medium temperature, and gradually raised to boiling, which is maintained for one hour to one and a quarter. This prolonged boiling is es-

sential for securing the equalization of the dye, though some dyes, such as Indigo Carmine, dye well at a somewhat lower temperature. Only in the case of light shades is three-quarters of an hour boiling sufficient; and here it is advisable for better equalization to dye with less acid and more Glauber's salt.

The basic dyestuffs are taken up by wool in a very uniform manner without the use of any adjuncts in the dye-bath, and the absorption begins at a temperature of  $86^{\circ}$  to  $104^{\circ}$  F. Hard water should be corrected with acetic acid until the reaction is slightly acid. The goods are entered lukewarm, and the operation is continued for about an hour, the temperature not being allowed to exceed about  $176^{\circ}$  F. Dyeings performed at boiling heat are less brilliant in color. Nevertheless, gentle boiling is admissible in the case of dark shades, and a few dyes of this class, such as Methyl Violet. Auramine must be dyed in a neutral bath.

The brightest colors are obtained by adding a little Marseilles soap to the neutral dye-bath and avoiding higher temperatures, about  $122^{\circ}$  F. being the limit. In this case, however, in order to avoid stains, the water must first be boiled with soap and the resulting scum removed.

In dyeing with mordant dyes, the nature of the bath water plays an important part, and, therefore, the water used must have been corrected with acetic acid; otherwise a partial precipitation of the color, in the form of lime and magnesia lakes, may occur. In some cases organic impurities have an unfavorable effect—*e. g.*, in the presence of Cochineal or Alizarine Blue.



The mordants used are various compounds of chrome, iron, and alumina. By the operation of mordanting, a deposit of oxide of the metal is formed on the fiber; and this, combining with the coloring matter, forms with it an insoluble colored body on the fabric, and so dyes it. The particular color thus developed on the fiber depends not only upon the coloring matter, but also upon the mordant which is used. Alizarine, for instance, dyed on an alumina mordant develops a scarlet, on a chrome mordant, a dark red, on an iron mordant a dark violet. The mordanting is usually done before the dyeing, but it may be done after the dyeing; much depends upon the character of the dyestuff which is used. Some coloring matters, such as Alizarine and Gambine, have but little affinity for the fiber and will not dye unmordanted wool. On the other hand, such dyestuffs as logwood, fustic, and some of the coal tar colors have considerable affinity for the fiber and may be first applied and then fixed by treatment with the mordant. In some cases the dyeing and mordanting may be effected in one bath. This method has the advantage of being quicker, more simple, and consequently cheaper, but in most cases the dyeings are not so full or not so well fixed as with goods previously mordanted.

*Preparing woollen garments for dyeing.* Proper cleaning is the prime requisite for successful dyeing. It is impossible to dye uniformly or of a good color on fabrics which are at all dirty. On goods which are not scrupulously clean the best dyes, even in the hands of the most skilful dyer, can give but second-rate results,

while it is a matter of experience that when the garments are properly cleaned before dyeing, a second-rate workman can get passable results with dyes which are by no means the best of their kind upon the market.

The first step is to sort the garments into four classes, the dirtier, dark-colored ones being put separate from the cleaner, dark-colored ones, and the same with those of the lighter shades. White goods are cleaned by soaking for 4 to 6 hours in a warm soap-bath containing a little ammonia.

In any case stains are first rubbed over with soap, and the garments are then worked for an hour in a carbonate-of-soda bath of from 1 to  $1\frac{1}{2}$  per cent. strength, and at a temperature of about  $120^{\circ}$  F. The cleaner goods are treated first, and one soaking will probably suffice, and will leave a bath which can be used for the first soaking of the dirty garments. All the goods are rinsed—first in a very weak soda-water, then in warm, and finally in cold water. For very dirty garments a soap washing may be necessary before the treatment with soda. Hangings and upholstery must first be worked in cold water to free them from dust, and then washed with soap in the washing machine, and finally rinsed as above described. The preliminary washing being finished, any remaining stains are removed, as far as possible, by the usual methods before the dyeing is begun. The next point is to strip the old dyes as far as possible, especially if the new shade is to be medium or light. In many cases boiling in plain water is sufficient. Woolens may

require treatment with nitric acid, but great care must be taken to have the acid sufficiently diluted. From 3 to 4° Bé. is a good strength. The action, too, should not be extended over five minutes, or the wool will receive too pronounced a yellow shade. Rinsing after the action of the acid must be ample and immediate. The acid bath can be used several times without renewal.

A very large number of receipts for dyeing wool could be given, but only such have been selected as comprise those shades which a dyer is most frequently called upon to dye.

*Black on wool. a. Jet black.* Make the dye-bath with 6½ ozs. Acid Black S, ¼ oz. Wool Yellow G, 5 ozs. sulphuric acid, and 1 lb. Glauber's salt. This bath shows how, by the addition of a little yellow, the blue shade may be changed to a full jet black.

*b. Dead black.* Make the dye-bath with 6½ ozs. Buffalo Chrome Black 2BN, 1½ ozs. Alizarole Yellow 3G, and 1 lb. bisulphate of soda. Work at the boil for 1 hour, then lift, add 5 ozs. fluoride of chrome, and work again at the boil for 20 minutes.

*c. Black on a woollen dress with silk trimmings.* To dye a woollen dress with silk trimmings, so that both the wool and the silk shall be dyed a uniform shade of black is by no means easy. Cleanse the dress thoroughly in soap, rinse well, and pass it through an acid bath. Next make a hot bath with copperas, 1 lb.; argol, 2 ozs.; bluestone, 2 ozs.; and fustic extract, 1 oz. Allow the dress to steep in this bath for two hours, turning it over at intervals, then take it

out, expose it to the air for half an hour, and rinse in water. Prepare a dye-bath with  $1\frac{1}{2}$  lbs. logwood and 1 oz. soap; enter the goods into this, and work for 15 minutes at the boil, then allow to steep in the hot, but not boiling, bath for one hour; lift, wash, and dry. As a rule, the best results will be obtained when the two baths are used under the boil.

*d. Chromotrop black.* Prepare the dye-bath with 9 ozs. superchrome Black BN Extra,  $\frac{1}{2}$  oz. Alizarine Yellow GGW, 1 lb. Glauber's salt, and  $6\frac{1}{2}$  ozs. sulphuric acid. Slowly raise to the boil and work for one hour; then add to the same dye-bath 5 ozs. bichromate of potash and  $1\frac{1}{2}$  ozs. sulphuric acid, working at the boil for one hour. This yields a jet black.

A blue black is obtained by using a bath containing  $9\frac{1}{2}$  ozs. superchrome Black 6BP, and  $6\frac{1}{2}$  ozs. sulphuric acid. Dye and develop the black by adding to the same bath 5 ozs. bichromate of potash and  $1\frac{1}{2}$  ozs. sulphuric acid.

*Gray on wool.* *a. Silver gray.* For 10 lbs. of goods dye in a bath containing 63 grains of Fast Wool Blue B, 35 grains of Fast Light Yellow, 14 grains of Azo Fuchsine, 1 lb. of Glauber's salt, and 4 ozs. of formic acid.

*b. Dark gray.* Prepare a bath from  $\frac{3}{4}$  lb. logwood and  $\frac{3}{4}$  lb. galls. Enter the goods into this and work for half an hour at the boil. Then lift, add  $\frac{1}{2}$  lb. copperas, re-enter the goods, and work for half an hour longer.

*Scarlet on wool.* Make the dye-bath with 2 ozs. Croceine Scarlet MOO and 1 lb. acetate of ammonia.

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This gives a good bright shade of scarlet which is fast to acids.

*Crimson on wool.* a. Dye with 5 ozs. of Safranine and  $1\frac{1}{2}$  lbs. Glauber's salt.

b. A very fine shade of crimson is dyed with  $1\frac{1}{2}$  ozs. of Fast Acid Violet R, 10 ozs. Glauber's salt, and 2 ozs. of sulphuric acid. •

*Deep red on wool.* Use a bath containing 5 ozs. of Union Red and 1 lb. of Glauber's salt.

*Ponceau on wool.* Prepare a bath with 3 ozs. Ponceau R, 1 lb. Glauber's salt, and  $3\frac{1}{4}$  ozs. of sulphuric acid. Enter the goods in the cold, bring to the boil and work to shade; wash and dry.

*Maroon on wool.* Make a dye-bath with  $1\frac{1}{2}$  ozs. of Acid Magenta, 2 ozs. of Orange G,  $\frac{1}{2}$  lb. of indigo extract,  $\frac{1}{2}$  lb. of Glauber's salt, and 4 ozs. of sulphuric acid. Work at the boil to shade.

*Claret on wool.* Use a bath containing  $6\frac{1}{2}$  ozs. Archil Substitute N, 1 lb. Glauber's salt, and 3 ozs. of sulphuric acid.

*Bright red on wool.* A good shade is dyed with  $6\frac{1}{2}$  ozs. Fast Fuchsine R, and 1 lb. of bisulphate of soda.

*Orange on wool.* Dye with 3 ozs. of Ponceau 3G, 1 lb. of Glauber's salt, and 3 ozs. of sulphuric acid.

*Yellow on wool.* Make a dye-bath with  $1\frac{1}{2}$  ozs. Fast Yellow FY, 1 lb. of Glauber's salt, and 3 ozs. of sulphuric acid, working at the boil to shade.

*Green on wool.* a. *Dark green.* Make a dye-bath with  $1\frac{1}{2}$  ozs. of Acid Blue G,  $1\frac{1}{2}$  ozs. of Azo Yellow Y, 2 lbs. of Glauber's salt, and 1 oz. of acetic acid.

b. *Sage green.* Make the dye-bath with 1 lb. Glau-

ber's salt, 3 ozs. of sulphuric acid, 3 ozs. of Azo Yellow, and  $1\frac{1}{2}$  ozs. Patent Blue N, working at the boil.

*c. Medium green.* Use a dye-bath containing 1 lb. of indigo extract, 2 ozs. of picric acid,  $1\frac{1}{2}$  ozs. of Acid Green,  $\frac{3}{4}$  lb. Glauber's salt, and 3 ozs. of sulphuric acid, working at the boil to shade.

*d. Olive green.* Make the dye-bath with 3 ozs. of Acid Green B, 3 ozs. of Acid Khaki H, 1 lb. of Glauber's salt,  $1\frac{1}{2}$  lbs. of bisulphate of soda. Work at the boil to shade.

*Blue on wool. a. Bright blue.* Prepare a bath with 3 ozs. of borax and  $1\frac{1}{2}$  ozs. of Alkali Blue B. Enter the goods at about  $170^{\circ}$  F., then heat to the boil and work for  $\frac{1}{2}$  hour. Then lift, rinse lightly, and pass through a weak sour bath with sulphuric acid to raise the color.

*b. Dark blue.* Prepare a dye-bath with 3 ozs. of Fast Wool Cyanole 3R, 1 lb. of Glauber's salt, and 3 ozs. of sulphuric acid, working at the boil for one hour.

*c. Navy blue.* Prepare a dye-bath with 2 ozs. of Induline A, 1 lb. of Glauber's salt, and 3 ozs. of sulphuric acid, working at the boil for one hour.

*Violet on wool. a. Pale violet.* Prepare a dye-bath with  $1\frac{1}{2}$  ozs. of Alkaline Sapphire,  $\frac{1}{2}$  oz. of Azo Rubine B,  $\frac{1}{2}$  lb. of Glauber's salt, and  $\frac{1}{2}$  lb. of acetate of ammonia, working at the boil for one hour.

*b. Violet.* Make the dye-bath with 3 ozs. of Wool Violet 4BS, 1 lb. of Glauber's salt, and 3 ozs. of sulphuric acid. This gives a pure violet shade. If Wool Violet 6BS is used, a bluer shade is obtained.

*c. Deep violet.* A fine deep shade is obtained by

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using  $4\frac{1}{2}$  ozs. of Azo Wool Violet 4B, 4 ozs. of Fast Wool Cyanine 3R, 1 lb. of Glauber's salt, and 3 ozs. of sulphuric acid, working at the boil for one hour.

*d. Mauve.* Use 3 ozs. Lanacyl Violet M, 1 lb. Glauber's salt, and 6 ozs. of acetic acid.

*Brown on wool.* *a.* Make the dye-bath with  $1\frac{1}{2}$  ozs. Buffalo Black B, 3 ozs. of Erie Brown R, and 2 lbs. Glauber's salt, working at the boil for one hour; then lift, wash, and dry.

*b. Deep brown.* Make the dye-bath with  $2\frac{1}{2}$  ozs. of Acid Orange Y, 2 ozs. of Wool Red 40F, 1 oz. Fast Wool Violet B.

*c. Olive-brown.* Make a dye-bath with 3 ozs. sulphuric acid, 1 lb. Glauber's salt,  $1\frac{1}{2}$  ozs. Azo Fuchsine G,  $\frac{3}{4}$  oz. Fast Yellow, and  $\frac{3}{4}$  oz. Fast Green extra bluish.

#### DYEING MIXED COTTON AND WOOL GOODS.

A large quantity of fabrics for men's suits are now made from wool and cotton. The garment dyer will obtain the best results in dyeing such goods by using union dyes, it being chiefly necessary that a little attention be paid, particularly to goods in which the cotton either appears on the surface forming a design, or is spun or twisted together with the wool. The direct dyes work, as a rule, on the two fibers with equal facility, especially if the dye-bath contains rather more Glauber's salt than usual. The direct dyes are also of considerable service, either used alone or with the addition of a wool dye, to shade off the wool part of the garment to the color of the cotton.

*Black.* a. For 10 lbs. of goods consisting of mixed material use 8 ozs. of Nacco Union Black, 4 ozs. of Neutral Wool Black,  $1\frac{1}{2}$  ozs. of Erie Yellow CG, 2 ozs. of Azo Wool Violet 4B, and 1 lb. of Glauber's salt for each 10 gallons of the dye liquor.

If desired the goods may be subjected after dyeing to a treatment with alum, or, better, bichromate of potash. The goods after being dyed are rinsed and then passed into a bath, at a temperature of  $140^{\circ}$  F., containing 3 lbs. bichromate of potash and  $1\frac{1}{2}$  to 2 ozs. sulphuric acid. After being chromed in this bath for about half an hour they are washed well. This chroming thoroughly fixes the color on the cotton, and it will not change while being finished either by steaming or hot pressing.

b. A very fine black can be obtained for 10 lbs. of goods from 5 ozs. of Direct Black conc.,  $3\frac{1}{2}$  ozs. of Union Black, 1 oz. of Neutral Black,  $\frac{1}{2}$  oz. of Acid Violet S<sub>4</sub>B, chroming after dyeing as explained above.

*Dark blue.* For 10 lbs. of union material, 2 ozs. of Fast Wool Cyanone R, 2 ozs. Diamine Black DB extra,  $1\frac{1}{2}$  ozs. Niagara Blue DE, and  $\frac{1}{2}$  lb. of Glauber's salt for each 10 gallons of the dye liquor.

*Dark brown.* For 10 lbs of goods use 6 ozs. of Union Seal Brown, 3 ozs. of Diamine Black DB extra,  $1\frac{1}{2}$  ozs. of Indian Yellow,  $1\frac{3}{4}$  ozs. of Acid Orange, 1 oz. of Cloth Red G,  $\frac{1}{2}$  oz. of Indigo Carmine Blue, and from  $\frac{1}{2}$  to 1 lb. of Glauber's salt per 10 gallons of dye liquor.

*Scarlet.* For a dye-bath of 25 gallons use  $1\frac{1}{2}$  lbs. of Benzopurpurine 4B,  $\frac{3}{8}$  oz. of Ponceau 3RB,  $\frac{1}{4}$  lb. of Indian Yellow, and 2 lbs. of Glauber's salt.



*Crimson.* For 5 gallons of dye liquor use 2 lbs. of Glauber's salt,  $\frac{1}{4}$  lb. of Congo Corinth G, 1 lb. of Benzopurpurine 10 B and  $\frac{1}{4}$  lb. of Curcumine S.

The so-called union colors are now manufactured in this country. Every desired shade can be obtained by the proper mixing of these colors. These dyes are Union Orange, Union Red, Union Scarlet, Union Brown, Union Khaki, Union Green, Union Blue, Union Violet, and Union Black. They are dyed in a neutral bath containing 1 lb. of Glauber's salt for pale shades, and 2 lbs. of Glauber's salt for medium and dark shades per 10 gallons of dye liquor. The Union colors are mixtures of substantive or direct colors and neutral dyeing wool colors. If the cotton is too light, as is often the case, the bath is cooled down and a proper amount of a substantive coloring matter is added which will almost wholly go on the cotton at a low temperature.

#### DYEING OF COTTON GOODS.

Cotton fabrics generally contain a size, which fills or envelops the fiber and thus impedes the uniform reception of the new coloring matter. Before dyeing, the complete removal of these foreign substances becomes, therefore, necessary. Simple wetting or washing in a soda-bath is not sufficient for this purpose. A reliable method for the removal of the size is as follows: Boil 22 lbs. of the fabric with  $3\frac{1}{2}$  lbs. of soda for one hour. Rinse, then work in a hot moderately sour sulphuric acid-bath for 10 minutes, and rinse thoroughly.

With the introduction of the direct dyes, cotton dyeing has become even more simple than wool or silk dyeing, and now all that is necessary is to prepare a dye liquor containing the necessary amount of dye-stuff and Glauber's salt, or common salt, or soda, or similar body, or a combination thereof. The method now working is to place the goods in a lukewarm, or even a hot, bath, raise to the boil, allow the goods to remain in the boiling bath for half an hour, then take them out, wring, wash, and dry. This method is simple, and will answer for all direct dyes. There are some that do not require the working to be done boiling, it being only necessary to enter the goods into a boiling bath and work without heat or steam until the bath has cooled down. Furious boiling is not needed, a gentle simmering giving the best results. An enormous variety of shades and tints can be combined together in every conceivable manner and proportion.

Although cotton dresses are but seldom brought to the professional garment dyer, such dresses being in most cases scarcely considered worth the trouble of re-dyeing, a few receipts for dyeing with direct colors are here given. The formulas are intended for 10 lbs. weight of goods.

*Scarlet on cotton.* Prepare the dye-bath with  $4\frac{1}{2}$  ozs. Direct Fast Red,  $\frac{1}{2}$  oz. Direct Orange Y, 5 lbs. salt. Work at the boil for 30 minutes, then lift, wash, and dry.

*Crimson red on cotton.* Make a dye-bath with  $6\frac{1}{2}$  ozs. Erie Crimson B, and 5 lbs. salt. Work at the boil for 50 minutes, then lift, wash, and dry.

*Pink on cotton.* Make the dye-bath with  $\frac{1}{2}$  oz. Erie Pink 2B, 8 ozs. salt, and  $4\frac{1}{2}$  ozs. soda.

*Claret on cotton.* Dye with  $2\frac{2}{3}$  ozs. Direct Garnet,  $4\frac{1}{2}$  ozs. soda, and 2 lbs. salt. Work at the boil for one hour.

*Maroon on cotton.* Dye with  $4\frac{1}{2}$  ozs. Direct Garnet,  $4\frac{1}{2}$  ozs. soda, and 2 lbs. salt. Work at the boil for one hour.

*Salmon on cotton.* Dye with  $\frac{1}{4}$  oz. Direct Fast Pink Y and 10 ozs. common salt, working at the boil for one hour.

*Yellow on cotton.* Make the dye-bath with  $1\frac{2}{3}$  ozs. Crysophenine and 1 lb. salt. Heat to  $180^{\circ}$  F., enter the goods, raise to boiling, and dye for one hour; lift, wash, and dry.

*Orange on cotton.* Use a dye-bath containing  $4\frac{1}{2}$  ozs. Erie Orange 2R, and  $2\frac{1}{2}$  lbs. salt. Work at the boil for one hour.

*Green on cotton.* Prepare the dye-bath with  $3\frac{1}{2}$  ozs. Direct Green C, 1 lb. Glauber's salt. Enter lukewarm, bring slowly to the boil; dye for one hour at the boil.

*Blue on cotton.* Use a dye-bath containing  $6\frac{2}{3}$  ozs. Niagara Blue 3B,  $3\frac{1}{2}$  ozs. soda,  $1\frac{1}{2}$  lbs. Glauber's salt. Dye at the boil for one hour.

*Violet on cotton.* Make the dye-bath with  $1\frac{1}{2}$  ozs. Erie Violet BW,  $1\frac{2}{3}$  ozs. soda, and 1 lb. Glauber's salt, and dye at the boil to shade.

*Brown on cotton.* a. Use  $6\frac{2}{3}$  ozs. Erie Brown GB, 2 lbs. Glauber's salt, and  $3\frac{1}{2}$  ozs. soda. Dye at the boil for an hour.

*b. Light brown.* Prepare the dye-bath with  $4\frac{2}{3}$  ozs. Direct Brown Y,  $4\frac{2}{3}$  ozs. soda,  $1\frac{1}{2}$  lbs. Glauber's salt.

*c. Dark brown.* Use a dye-bath containing 8 ozs. Direct Dark Brown,  $4\frac{2}{3}$  ozs. soda,  $1\frac{1}{2}$  lbs. Glauber's salt. Dye at the boil for one hour.

*Black on cotton.* Prepare the dye-bath with 8 ozs. Erie Black GXOO, 2 lbs. Glauber's salt, and 3 ozs. soda. Dye at the boil for one hour.

*Deep black.* Prepare the dye-bath with  $8\frac{1}{3}$  ozs. Erie Black NR, extra,  $3\frac{1}{3}$  ozs. soda, 2 lbs. Glauber's salt. Dye for one hour at the boil, lift, rinse, and dry.

*Gray on cotton.* By using the direct blacks in proportions varying from  $\frac{1}{4}$  to 1 per cent. of the dyestuff to the weight of the goods, they give grays of various tints and depths.

#### DYEING COTTON AND LINEN GARMENTS CONTAINING JUTE.

Fabrics used for these articles consist usually of a cotton or linen warp and a jute weft. They require considerable care in dyeing, as the jutes has a much greater affinity for nearly every known dye than either linen or cotton. Jute, for example, can be dyed direct with basic dyes in an alum bath without previous mordanting, the bath exhausting well, while cotton or linen must first be mordanted to get even medium and particularly dark shades with a basic dye. In dyeing mixtures of cotton and linen with jute black, for instance, with a basic dyestuff, the weft will come out black, while the warp remains a dark gray at the

best. The most common colors for these mixed goods are blacks, reds, blues, and yellows, mixed and mode shades being less usual. The dyes most in use for pure jute are Coal Black, Victoria Blue, Croceine Scarlet, and Auramine Yellow, but they are quite unsuitable for mixtures of jute with cotton and linen. For them, direct or substantive dyes are best, such as Direct Black, conc., Benzopurpurine 4B, Direct Blue 2B, and Chrysophenine. Even these go somewhat deeper onto jute than onto cotton or linen. The remedy for all these difficulties is to mix the dye with the dressing. All the three fibers are then dyed alike, but the exact quantity of dye to take must be accurately judged. Too much dye causes a bronzing of the color of the jute, while, if there is any deficiency of dye, the leveling is lost and the cotton or linen comes out paler than the jute. The following receipt has stood the test of prolonged trial very satisfactorily for *black*.

Wheat starch,  $2\frac{1}{2}$  lbs.; 50 per cent. Turkey-red oil,  $1\frac{1}{2}$  lbs.; Erie Black NR, extra,  $1\frac{1}{2}$  lbs.; Direct Green C, 8 ozs.; Glauber's salt, 3 lbs.; carbonate of soda, 8 ozs.; tallow,  $4\frac{1}{2}$  ozs.; water, 10 gallons.

Pass the goods slowly through this size at a temperature of from  $176^{\circ}$  to  $194^{\circ}$  F., and dry immediately. Not only is the color good, but much labor is saved. Any direct dye can be applied in size in a similar way.

## X.

### STRIPPING COLORS FROM GARMENTS AND FABRICS.

THE garment dyer has generally to deal with garments that are still in a fair state of preservation, but that have faded colors. This color has to be restored or a darker shade dyed, but in some cases the customer will require that a lighter shade be dyed, in which case it is necessary to remove the old color before a lighter one can be applied. In very many cases it is unsatisfactory and dangerous to attempt to remove the old color from a garment, and as a rule garment dyers are adverse to doing any stripping, dyeing only such colors as may be dyed over the old color. However, regardless of his feeling in this matter, or his business policy in this respect, he should have a knowledge of how to strip old colors, for it sometimes happens that he must resort to it for one reason or another. In any event he should understand that stripping is very liable to injure the fabric, and that the operation must be carried out with due regard for the material being treated.

Stripping is generally done by working according to one of the following methods:

1. *For all-wool and half-wool goods.* Prepare a bath

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having a temperature of from 100° to 120° F., containing from 5 to 10 per cent. of soda ash, or an equal amount of ammonia. Soak the material in this bath for from 20 to 30 minutes and then rinse well. The goods are then boiled for a short time in water to which some wheat bran has been added. In some instances the goods are also soured off hot with sulphuric or hydrochloric acid and rinsed thoroughly.

2. *Method for stripping goods dyed with aniline colors.* Enter the woolen goods or other material that has previously been scoured into a cold or lukewarm solution of from  $\frac{1}{2}$  to 1 lb. of soda ash in 10 gallons of water. Keep the material in this bath for a short time, after which rinse them well. This preliminary treatment will strip a large number of aniline dyes. Subsequent stripping may be done with Ronzalite, Strippene, Dye Skat, or a similar commercial stripping preparation. Wood vessels should be used in which to do the work, and to prevent spots and stains all exposed steam-pipes should be wrapped with cloths.

From 3 to 5 ozs. of Ronzalite, or other commercial preparation, should be used, the amount varying with the nature and the color to be removed. In each case acetic acid should be added to the stripping-bath. The amount of acid to use should be double the amount of the stripping preparation.

Before using Ronzalite it is dissolved in warm water. The stripper and the acetic acid are then added to the bath at the same time. The bath should be lukewarm and should be kept concentrated. Enter the goods and slowly raise the bath to the boil and keep it

at this temperature for from  $\frac{1}{2}$  to  $\frac{3}{4}$  hours. At the end of this time remove the goods and rinse them well.

Dye Skat will not dissolve in cold water, and is added to the bath after it has been brought to the boil.

3. *Stripping with bichromate of potash and sulphuric acid.* The commercial stripping preparations mentioned above exert little effect on the colors of woolen goods that have been dyed with the natural dyestuffs, such as logwood, fustic, etc. In this case the best results are obtained by boiling the material for from  $\frac{1}{4}$  to  $\frac{1}{2}$  hour in a bath made up as follows: From  $3\frac{1}{2}$  to 6 ozs. of bichromate of potash and from 7 to 10 ozs. of sulphuric acid. In place of sulphuric acid an equal amount of oxalic acid may be used.

4. *Stripping with hot nitric acid.* There is grave danger of tendering the goods when using dilute nitric acid for stripping purposes, and its use should be resorted to only in extreme cases. Care should be taken to see that the acid is sufficiently diluted before the goods are placed in the bath. Nitric acid is used for stripping woolen and silk goods only. Its use cannot be recommended to one who has had no experience in its use.

5. *Stripping silk and half-silk.* Boil the material to be stripped for about an hour in a soap-bath containing  $\frac{1}{2}$  lb. of soap per 10 gallons of water, and rinse. If the stripping is not satisfactory one of the commercial stripping preparations such as mentioned above should be used.

Hydrosulphite, the active agent of commercial



strippers, is a very effective stripper for all dyes except indigo. The action of hydrosulphite decolorized this dye, but the color returns when the garment is exposed to the air. Tendering of the fabric when hydrosulphite is used is not so evident when the temperature of the bath is kept down to 120° to 140° F., but, unfortunately, a good strip will not often be had at these temperatures, and boiling must be resorted to.

There are a number of hydrosulphite compounds on the market, and there is seldom any occasion for the dyer to make his own. However, should he desire to do so he may proceed as follows: Bisulphite of soda and zinc powder are required. Thirteen ounces of zinc are stirred into each gallon of the bisulphite. The liquor heats up as the zinc is stirred into it, and the vessel containing the bisulphite should be kept in cold water. The zinc should be slowly stirred in until no further odor of sulphur is given off. The mixture then should be allowed to settle, and the clear liquor drawn off for stripping use. The compound is not stable and readily absorbs oxygen from the air. It should be kept in tightly corked bottles.

Low-class unions, such as are now used extensively for men's suitings, are difficult to strip without damaging them. The ordinary strip in a strong bath of chromic acid is often used for this class of goods. This is made by boiling bichromate of soda with sulphuric acid. The usual percentage is five on the weight of the goods. The stripping-bath is raised to the boil, the goods entered and the boiling continued for ten

minutes, which is sufficient to strip off the dye down to a light brown. Continued boiling will serve only to tender the goods. A thorough washing in cold water should be given the goods as soon as they are removed from the stripping-bath to free them from acid.

## XI.

### ANALYSIS OF TEXTILE FABRICS.

THE dyer and cleaner should be able to analyze cloth by simple means. Linen, silk, and wool are largely adulterated with cotton, and all these fibers behave differently even in ordinary washing. Moreover, the varieties of unions and mixture cloths are constantly increasing, and in these days of mercerization and other processes, the sight and touch are not sufficient to identify a material. Also, now that cellulose is being so largely used in the manufacture of artificial silk or lustra-cellulose, it is often important to be able to decide the particular form of the cellulose employed in their formation—*i. e.*, whether the fibers are derived from nitro-compounds, pure cellulose, or mixed in origin, as when associated with gelatine or dissolved silk, and woven along with wool.

In determining these various points there are now a number of methods which enable all these various questions to be very easily decided, and a complete analysis of any fabric containing mixed fibers or any mixture of fibers can thus be made. As a rule, in examining any mixture of textile fibers for ordinary

purposes, it is only necessary to distinguish between wool and other animal fibers, and cotton, flax, jute, hemp, and ramie in vegetable fibers, and silk, cultivated, wild, and artificial, as these are almost all the fibers in general use.

The means employed are of two kinds:

1. *Mechanical*, in which the specific differences in structure, as revealed under the microscope, are seen; and

2. *Chemical*, in which the distinctive colors and other reactions, when treated with various reagents are employed, or the variation in solubility or degree of solubility in different reagents. Also the difference in degree of inflammability or behavior when subjected to various degrees of heat.

*Mechanical analysis.* When the fibers are placed under the microscope, especially with transmitted light, and with powers varying from 20 to 500 diameters, which is well within the range of any ordinary cheap, yet reliable, microscope, the following distinctions are usually clearly visible:

*Cotton.* This fiber appears under the microscope as a granular striped band, mostly twisted in the shape of a corkscrew, which is more particularly evident when the fiber is moistened with water. The fiber is a flattened cylindric tube with thickened walls.

*Flax* consists of the bast fibers from the plants of the *Linum* family. Under the microscope the flax fiber appears as a long, straight, cylindrical tube of uniform thickness, either smooth or longitudinally striated, and frequently exhibiting transverse cracks.

In many places it presents nodes and displacements, which cause it to look as though articulated.

*Hemp.* Examined under the microscope the fiber of hemp is very similar to flax, exhibiting displacements, longitudinal fissures, and transverse cracks; but it is less regular in thickness. The ends of the fibers are very characteristic, being very thick-walled and blunt, frequently branching sideways and thus affording a ready means of distinguishing this fiber from flax.

*Jute.* In microscopic structure jute fiber exhibits a certain similarity to hemp and flax, but the longitudinal view shows neither displacement nor striations.

*Silk.* Under the microscope the silk fiber exhibits the appearance of a clear, cylindrical double thread enclosed in a cloudy integument. It appears smooth and free from scales.

*Tussah silk.* Under the microscope this variety of silk exhibits a highly characteristic appearance, differing greatly from cultivated silk, the fibers showing strong striation and being apparently much constricted in parts. Unlike true silk, the fiber is not of circular cross section, but of elongated quadrilateral form.

*Artificial silk or lustra-cellulose* is, in appearance, under the microscope very similar to silk, but it does not exhibit the double strand of the cultivated silk, or the flattened and striated appearance of Tussah silk.

*Wool.* When a fiber of sheep's wool is examined under the microscope, it is seen to consist of three parts, distinguished respectively as the scaly epider-

mis, the cortex, and the medulla or pith. The outer scaly epidermis is composed of thin horny scales lying one above the other like the tiles of a roof. In the finer qualities of wool a single scale is generally sufficient to entirely surround the wool hair, so that the latter seem to be formed of a number of cups set one within another, the upper of each scale being also generally projecting, ragged, and serrated. The scales form the chief external characteristics of sheep's wool, and render its detection under the microscope an easy task.

*Hair* differs in appearance from wool, in so much as though it is usually covered with similar scales on the surface of the hair, they are always more closely adherent to the shaft of the hair and the edges are not turned outwards. Alpaca, vicugna, Cashmere goat hair, all closely resemble each other and mohair in having the scales more closely adherent to the shafts of hair than in the true wools. The hair of almost every class of animals has distinctive features, in the form and arrangement of the surface scales or the internal cells.

*Chemical analysis.* There are many intricate and elaborate means of chemically examining fibers and fabrics, but they are too troublesome for the use of the cleaner and dyer, and we shall therefore confine ourselves to those which are more easily attainable.

A very ready method of distinguishing between fibers of vegetable and animal origin is the way in which they burn when a flame is applied to them.

*Vegetable fibers*, when dry, all ignite and burn with

a comparatively bright, smokeless and odorless flame, and leave very little ash. If the flame is extinguished before the whole of the fiber or thread is consumed, the fiber is burnt off sharply at the end, and leaves a blackened or carbonized edge where the burning ceased.

*Animal fibers*, even when dry, and unless containing an amount of extraneous fat or oil, are more difficult to ignite, and unless the mass is large, the flame will frequently go out if the fiber is held horizontally, although if held vertically, and lighted at the bottom it may continue to burn without a fresh application of the fire. The flame is usually more or less dull and lifeless, and burns slowly, with emission of a disagreeable empyreumatic odor, resembling the smell of burning feathers, and when extinguished the burnt edge is not clear and sharp, but fused into a rounded beadlike form, which retains the odor and feels sticky if crushed between the thumb and fingers.

Cellulose forms the basis of all vegetable textile fibers (cotton, flax, hemp, etc.), and they, therefore, vigorously resist the action of even boiling-hot aqueous solutions of the caustic alkalies, while they are strongly attacked by heated sulphuric, nitric, and hydrochloric acids, either in a concentrated or diluted state. Thus, for instance, a cotton fabric may, without suffering great injury, be immersed in cold water containing 5 to 10 per cent. of acid; but on heating the fluid, especially to the boiling-point, the cotton in a short time becomes friable and dissolves.

Fuming nitric acid, or a mixture of nitric and sul-

phuric acids, does not dissolve the vegetable fiber, but converts it, almost without changing its physical appearance, into guncotton.

Ammonia, either at the ordinary or a raised temperature, produces no effect upon cotton and hemp. However, a solution of ammonia-oxide of copper (Schweitzer's reagent) dissolves cotton, hemp, and flax.

In a pure state, vegetable textile fibers have but a feeble affinity for artificially prepared coloring matters, they being but slightly or not at all dyed by them, and the application of a little soap suffices to remove the dye. They do not evolve a characteristic odor in burning.

*Wool*, on the other hand, resists the action of even concentrated and hot acids quite well, but is dissolved, especially at a higher temperature, by caustic lyes. Since wool contains sulphur, there is formed by its solution in caustic soda a fluid which contains alkaline sulphide and sulphydrate, which are indicated by a beautiful violet tint produced by the addition of nitroprusside of sodium. Nitric acid imparts to wool an intense yellow color; chlorine and hypochlorites act in a similar manner, they also imparting to wool a yellow color. At the ordinary temperature Schweitzer's reagent has no effect on wool, but when heated dissolves it. When decomposed by heat, wool evolves the characteristic odor of burnt horn. It possesses great affinity for coloring matters, especially for those artificially prepared, by which it is readily dyed without a mordant.

*Silk*, when burned, evolves an odor similar to wool.



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It is dissolved, especially at higher temperatures, by the above-mentioned acids in a concentrated state. Cold nitric acid colors silk yellow. Acids diluted with water do not act very vigorously upon silk. Concentrated alkaline lyes dissolve it, but the solution does not contain alkaline sulphide like that of wool. Silk is changed, but not dissolved, by very dilute alkaline lyes. Ammonia produces no effect on it, while Schweizer's reagent dissolves it. The affinity of silk for coloring matter is the same as that of wool.

To establish the presence of vegetable fibers (cotton, hemp, flax, jute, etc.) in a tissue consisting of wool and silk, it is only necessary to boil the latter in a test-fluid containing  $3\frac{1}{2}$  ozs. solid caustic soda in one quart of water. Weigh out accurately  $\frac{1}{2}$  to 1 drachm of the fabric to be examined; introduce this sample, together with  $\frac{1}{10}$  quart of the soda-lye, into a porcelain casserole of about 1 pint capacity, and boil it over an alcohol or gas flame for five minutes. If the mass dissolves, it consists only of animal fiber (silk or wool), but if it is not entirely dissolved, take the casserole from the fire, allow to settle, pour off the supernatant lye, and after adding fresh lye, boil again for five minutes. If a residue now remains, it consists entirely of vegetable fiber. If the vegetable fiber is colored, the residue is brought upon a small cotton filter and washed with hot water. The washed fiber is then brought into lukewarm water acidulated with about 5 per cent. hydrochloric acid. After ten minutes add a little chlorine water, or a few drops of chloride of lime solution, whereby the vegetable fiber is bleached.

The filtrate of the caustic soda solution, which contains wool or silk, may now immediately be tested as to the presence of wool. If the latter is present, alkaline sulphides have been formed, which remain in the solution. They can be immediately detected by the addition of a few drops of acetate of lead solution. If a white precipitate is formed, which is completely dissolved on shaking, silk only is present; however, if a black precipitate of sulphide of lead is formed, the tested tissue contains wool. Instead of acetate of lead solution, a few drops of nitro-prusside of sodium solution may be used, which, as previously mentioned, produces in the presence of alkaline sulphides a beautiful violet tint.

If the tissue is provided with much coloring matter E. Kopp recommends to cut the sample into small pieces and immerse the latter, with occasional stirring, for five minutes in a mixture of 2 volumes sulphuric acid of 60° Bé., and 1 volume fuming nitric acid of 60° Bé. By this means the wool, silk, and coloring matters are oxidized and destroyed, while the vegetable fiber is converted into guncotton, and retains its characteristic fibrous nature. The whole is then brought into a comparatively large quantity of water, in which the guncotton deposits. The fluid is then poured off, while the residue is collected upon a filter, thoroughly washed, and dried. The dry residue now shows the explosive property of guncotton.

For testing white, or not too dark-colored, mixed tissues, the affinity of the animal fibers for the artificially prepared coloring matters may also be utilized.

Dark-colored tissues must first be decolorized by treatment with weak chlorine water, and subsequent thorough washing in boiling water. Certain precautions have, however, to be observed, since cotton, especially when impregnated with amylaceous or other substances serving for sizing, may also be dyed with aniline colors. These substances must first be removed, and for this purpose the tissue is first boiled for ten minutes in water which contains in 100 parts 2 parts of carbonate of soda and a little soap. The tissue is then rinsed in hot water, next steeped for five to ten minutes in water of 120° to 140° F., which contains 2 per cent. of hydrochloric or sulphuric acid, and finally thoroughly washed. In the meanwhile prepare a dye-bath by, for instance, dissolving a few drachms of Fuchsine in 25 to 30 cubic centimeters of water, heating the solution to boiling, and adding, during the boiling, caustic soda solution, drop by drop, until the bath shows only a pale rose color. Now remove the bath from the fire and introduce the tissue; take it out after a few minutes, thoroughly wash it in clean water, and dry. The silk and woollen threads will be colored bright red, while the cotton, flax, etc., remain uncolored.

For the detection of silk in wool, or wool in silk, in white or light-colored tissues, the presence of sulphur in the wool may be utilized. Prepare a solution of oxide of lead in caustic soda by boiling litharge in the latter and, after settling, pouring off the clear fluid. Immerse the tissue in the latter. In consequence of their content of sulphur the woollen threads immediately become black by the formation of black

sulphide of lead, while the color of the silk threads, which contain no sulphur, remains unchanged.

A simple method consists in the use of concentrated acids. Cold nitric acid dissolves silk, while wool is not perceptibly attacked by it. Silk acts in the same manner towards sufficiently concentrated cold sulphuric acid. The last-mentioned acid at the same time frees the wool from vegetable fibers by converting them into gum and sugar.

It is better, however, to immerse the sample of the tissue in cold concentrated hydrochloric acid. The silk is in a short time completely dissolved, while the woolen and vegetable fibers remain behind unchanged. Now add water, collect the unchanged woolen and vegetable fibers upon a filter, and wash thoroughly. As a rule, they must also be decolorized.

Now to distinguish the woolen from the vegetable fibers, treat them either with boiling caustic soda-lye, which only dissolves the wool, or use artificially prepared coloring matters, such as Fuchsine, Aniline Violet, or picric acid, which do not dye the cotton if the necessary precautionary measures are taken.

Before subjecting the tissues to a chemical test, it is advisable to free them from their sizing and coloring matters, the first of which is effected by successive treatment with boiling water, either pure or slightly acidulated, or made alkaline by the addition of carbonate of soda, and the latter by chlorine water. The tissues are finally carefully washed and dried.

Below a summary for distinguishing the purity of a fabric by chemical agents is given:

*Cotton* is completely decomposed by, and forms a powder after being immersed in strong hydrochloric acid and dried. It is completely decomposed in a hot and strong solution of nitric acid. Weak sulphuric acid stains cotton blue.

*Cotton in linen cloth* can be detected by immersion in caustic potash solution (1 to 2), and then washing and drying. The flax is colored a deep yellow, but the cotton is not affected. Boiled in concentrated sulphuric acid for a minute or two, the cotton fiber is dissolved, but not the flax. Boiled in water and dried, immersed in a strong solution of common salt and sugar, and then burnt, the cotton yields a black, and the flax a gray, ash.

*To determine whether a so-called woolen cloth contains cotton*, a 2 per cent. soda lye may be used. After drying, the fibers are separated. The remaining wool is weighed and compared with the original weight.

*Jute* is colored dark brown by sulphuric acid.

*Linen* acquires a blue color when treated with dilute sulphuric acid.

*Silk* is dissolved by hot solutions of caustic soda, and destroyed by strong solutions of zinc chloride. Strong solutions of hydrochloric, nitric, and sulphuric acids dissolve silk immediately.

*Tussah silk* is stronger than true silk. It is not affected by a weak solution of caustic soda, which will dissolve true silk.

*Viscose silk.* This is the artificial silk most used in this country, and seems to be the best-wearing and strongest artificial silk made. It is manufactured from

wood pulp. It is destroyed at a temperature of about 300° F., and is much weaker when wet. For these reasons care must be used when wet cleaning and finishing it to prevent damage. To determine mercerized silk and artificial silk from each other the burning test may be used. The artificial silk and the cotton will burn with a bright flame, leaving a light ash behind. The silk burns like wool. Silk is soluble in caustic soda, while cotton and artificial silk are not.

*Cotton present in a so-called woolen fabric* dissolves in a weak solution of hydrochloric acid.

*Cloth containing silk and wool* can be recognized by boiling in a hydrochloric acid solution. The silk is dissolved while the wool swells.

*Iodine and sulphuric acid* in weak solution impart a *blue* stain to *flax*; a *greenish-yellow* stain to *hemp*; a *blue* stain to *rhea fiber*; a *dark yellow* stain to *jute*.

Caustic soda in a solution of about 26.5° Bé. causes the cotton fiber to shrink in length and become more transparent and lustrous. Cloth treated thus is called *mercerized cloth*.

The difference between mercerized and unmercerized cotton is easily detected by using the test first pointed out by Prof. Julius Hübner, of the Manchester Municipal Technical College. If the two cottons are immersed in a solution of zinc chloride, 100 c.c. of solution containing 93.3 grammes of zinc chloride, to which two drops of a solution of iodine in potassium iodide have been added, the ordinary cotton remains white, while the mercerized cotton takes a dark navy-blue color. The depth of the color ac-

TABLE OF REACTIONS OF ANIMAL AND VEGETABLE FIBERS.

REAGENT.	Cotton.	Flax.	Hemp.	Jute.	Ramie.	Lustra-Cellulose.	Wool and Hair.	Silk.	Gelatine Silk.
Ammonia solution.	—	—	Yellow or violet.	—	—	—	—	—	—
Chlorine water.	Bleaches.	Bleaches.	Yellow-brown.	Violet on addition of ammonia.	—	—	Yellow.	Yellow.	Yellow.
Cupra-ammonium solution.	Blue solution.	Blue solution.	Blue solution.	Blue solution.	Blue solution.	Blue solution.	Swells.	—	—
Cupric sulphate.	—	—	—	—	—	—	Black.	Violet.	—
Iodine solution.	Yellow.	Yellow.	—	Light brown.	—	Yellow.	—	—	—
Iodine and sulphuric acid.	Blue.	Blue.	Green.	Yellow to brown.	Dull blue.	Blue.	—	—	—
Iodine and zinc chloride.	Deep violet.	Violet.	Violet.	Brown.	Dull violet.	Blue violet.	—	Yellow.	Yellow.
Lead acetate.	—	—	—	—	—	—	Black alkaline solution.	—	—
Mercuric nitrate.	—	—	—	—	—	—	Red to brown.	—	—
Nitric acid.	—	—	Yellow.	—	—	—	Yellow.	Yellow.	Yellow.
Picric acid.	—	—	—	—	—	—	Yellow.	Yellow.	Brown yellow.
Potash (caustic) solution.	Yellow.	Brown.	Brown.	Brown.	Brown.	Yellow.	Dissolves.	Dissolves.	Dissolves.
Silver nitrate.	—	—	—	—	—	Violet to brown.	—	—	—
Soda (caustic) solution.	Yellow.	Brown-yellow.	Brown.	Brown.	Light brown.	Yellow.	Dissolves.	Dissolves.	Dissolves.
Stannic chloride.	Black.	Black.	Black.	Black.	Black.	Black.	—	—	—
Sugar and sulphuric acid.	—	—	—	—	—	—	Rose red.	Rose red.	—
Sulphuric acid.	Dissolves.	Dissolves dark color.	Dissolves dark color.	Dissolves.	Dissolves.	Dissolves.	Dissolves when hot.	Dissolves when hot.	Dissolves when hot.
Zinc chloride.	—	Dissolves yellow.	Dissolves yellow.	Dissolves.	Dissolves.	Dissolves yellow.	Dissolves slowly.	Dissolves.	Dissolves slowly.

TABLE OF REACTIONS OF VARIOUS DYEING MATERIALS.

DYEING MATERIAL.	Cotton.	Flax.	Hemp.	Jute.	Ramie.	Lustra-Cellulose.	Wool and Hair.	Silk.	Gelatine Silk.
Acid dyes in general.	—	—	—	—	—	—	Dyed.	Dyed.	Dyed.
Alpha-naphthol and sulphuric acid.	Red or violet.	Red or violet.	Red.	Red.	Red.	Red.	Reddish-brown.	Yellow-brown.	Brown.
Cochineal tincture.	Light red.	—	—	Red.	Reddish.	Red.	Scarlet.	Scarlet.	Scarlet.
Diphenylamine and sulphuric acid.	—	—	—	—	—	Blue silk-cotton.	—	—	—
Fuchsine solution.	—	—	—	—	—	—	Red.	Red.	Brown.
Madder tincture.	Yellow.	Orange.	Reddish.	Reddish.	Reddish-brown.	Yellow.	—	—	—
Mikado yellow.	Dyed.	Dyed.	Dyed.	Dyed.	Dyed.	Dyed.	—	—	—
Thymol and sulphuric acid.	Violet.	Violet.	—	—	—	Violet.	—	—	—



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quired measures the degree of mercerization to which the cotton has been subjected.

The tables on pages 352 and 353 give at a glance the reactions of animal and vegetable fibers, undyed or after removal of the dye by bleaching, with various chemical reagents, and the reactions of various dyeing materials.

## XII.

### PRACTICAL CHEMISTRY FOR THE CLEANER AND DYER.

IN these days the cleaner and dyer who would be successful must be somewhat of a chemist. By this it is not meant that he must have a thorough knowledge of this subject, or that it is necessary for him to take a college course in this subject, but that he should know and be familiar with a rather long list of chemicals, their characteristics, and how and for what purposes they are used in the cleaning and dyeing departments of a cleaning plant. Also he should be able to make a few simple chemical tests to determine certain facts in the course of his day's work. For example, it is often of value to know whether or not a piece of silk is loaded and what the material is with which the loading was done, what particular dye a garment is colored with, what class a dyestuff belongs to, etc. As a rule the practical cleaner and dyer has not had as great a knowledge of the different chemicals used in the business as he should have had, although at the present time there is more of a disposition on the part of these tradesmen to pay more attention to this phase of the subject. The advances that have been

made in the art of cleaning and dyeing during the past several years make such knowledge imperative if the best grade of work is to be turned out. Following are listed in alphabetical order those chemicals most frequently used by cleaners and dyers, with a brief description of them and their uses:

*Acetate of chrome* ( $\text{Cr}_2(\text{C}_2\text{H}_3\text{O}_2)_6$ ) is used in dyeing as a mordant by piece dyers, but it is very seldom used by garment dyers.

*Acetate of soda.* See Sodium acetate.

*Acetic acid* ( $\text{C}_2\text{H}_4\text{O}_2$ ). This acid is used in the cleaning and dyeing plant to a greater extent than probably any other. It is used in the spotting department, as a 5 per cent. solution for the removal of alkali stains, for dyeing and for bleaching purposes in combination with certain other chemicals. It has an odor similar to vinegar and possesses characteristics akin to formic acid. The latter acid, however, is the stronger, 1 part of formic being equivalent to 6 parts of acetic. Acetic acid is used for dissolving colors and for dyeing basic colors on cotton. The addition of the acids retards the absorption of the dyestuff, and thus produces more even dyeings. The acid is also used in conjunction with the hydrosulphites for stripping purposes.

*Alum, potassium aluminium sulphate* ( $\text{K}_2\text{SO}_4\text{AL}_2(\text{SO}_4)_3 + 24 \text{ H}_2\text{O}$ ) comes in the form of white crystals that are readily soluble in water. The principal uses of alum are in the dye-house, where it is used as a retarding agent when dyeing basic colors on cotton. Acetic acid, however, is the better chemical to use

for this purpose, as it does not produce the harsh feel left by the alum.

*Ammonia* ( $(\text{NH}_4)_2\text{CO}_3$ ) is an alkali used in the spotting room for the removal of acid stains, in the cleaning department as an addition to wash waters for scouring woolens, and as an addition to benzine soap for cleaning gloves. The stale urine so extensively used in olden times for scouring wool possessed ammonia as the active principle.

*Ammonium hydroxide* ( $\text{NH}_4\text{OH}$ ) is a solution of ammonia gas in water. It is used both in the cleaning and in the dyeing departments, in the former as a spotting agent, and in the latter as a substitute for other alkalies when dyeing vat colors on wool. When used as a spotting agent it should be in a 10 per cent. solution. Ammonium hydroxide is an alkali and very volatile.

*Benzine, gasoline, naphtha* are distilled from crude petroleum. Their uses in the cleaning plant are too well known to merit description here.

*Bichromate.* See Potassium bichromate.

*Bisulphite of soda* ( $\text{NaHSO}_3$ ) may be had either in the form of a colorless liquid or a white powder. It is a bleaching agent, and is used in combination with sulphuric acid for bleaching wool. The active bleaching agent is sulphur dioxide. It is also used in the dye-house as an after-treating agent to brighten the shades of sulphur dyestuffs.

*Bluestone.* See Copper sulphate.

*Blue vitriol.* See Copper sulphate.

*Borax* ( $\text{Na}_2\text{B}_4\text{O}_7 + 10 \text{H}_2\text{O}$ ). A mild alkali that is

useful for scouring and wet-cleaning purposes. It is also used in the dye-house during the process of dyeing Alkali Blue.

*Calcium hydrochlorite, chloride of lime* ( $\text{CaOCl}_2$ ) is used for bleaching vegetable fibers. It comes in the form of a white powder, and as it really absorbs moisture from the air it should be stored in a dry place. Its preparations and uses are fully described on another page of this book.

*Carbolic acid.* See Phenol.

*Carbon tetrachloride* ( $\text{CCl}_4$ ) boils at  $176^\circ \text{F.}$ , and is very volatile. Its use in the cleaning plant is confined chiefly to spotting purposes. Its chief value lies in the fact that it does not leave spotting rings. It readily removes grease, tar, rubber, oil, and similar stains. It is non-inflammable.

*Caustic soda* ( $\text{NaOH}$ ) is manufactured in the form of a white mass or white crystals. Its use in the cleaning plant is confined almost entirely to dissolving certain of the developers and for testing fabrics to determine the cotton and wool contents. It readily dissolves animal fibers.

*Chloroform* ( $\text{CHCl}_3$ ) is used in the cleaning plant as a grease and paint remover. Stains that cannot be removed by other solvents frequently yield to this chemical. It is not inflammable.

*Chrome.* See Potassium bichromate.

*Chrome acetate.* See Acetate of chrome.

*Chrome alum* ( $\text{Cr}_2\text{K}_2(\text{SO}_4)_4 + 24 \text{H}_2\text{O}$ ) comes in the form of large crystals having a purplish color. It is used in the dye-house, principally, for after-treating

certain direct colors to render them faster to washing.

*Chromium fluoride* ( $\text{Cr}_2\text{F}_2 + 8 \text{H}_2\text{O}$ ). A green powder that dissolves readily in water. Its principal use is in the dye-house for treating direct reds and Alizarine colors.

*Copperas*. See Ferrous sulphate.

*Copper sulphate* ( $\text{CuSO}_4 + 7 \text{H}_2\text{O}$ ) comes in the form of large blue crystals which dissolve readily in water. This chemical is used exclusively in the dye-house as an oxidizing and after-treating agent. Direct colors are made faster to light when after-treated with copper sulphate. It is also used for an oxidizing agent when dyeing aniline black and logwood.

*Cream of tartar* ( $\text{KHC}_4\text{H}_4\text{O}_6$ ). A white powder somewhat soluble in water. It was formerly used in the dye-house as a mordanting assistant, but its use has been largely replaced by lactic acid.

*Epsom salt*. See Magnesium sulphate.

*Ethyl alcohol* ( $\text{C}_2\text{H}_5\text{OH}$ ) is distilled from grain and is used as a solvent for dyes, and to a limited extent for spotting purposes. When spotting colored fabrics with ethyl alcohol extreme care must be used, otherwise the color is very liable to be damaged.

*Eau de Javelle*. See Sodium hypochlorite.

*Ferrous sulphate* ( $\text{FeSO}_4 + 7 \text{H}_2\text{O}$ ) has the form of green crystals which are soluble in water. It is a mordant and is used when dyeing with logwood, indigo in the copperas vat, cotton with logwood and khaki shades.

*Formaldehyde* ( $\text{CH}_2\text{O}$ ) is sold on the markets as a

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40 per cent. solution of the gas. It has a very unpleasant odor and acts as an irritant to the eyes. It has a number of uses in the dye-house, chief of which is as an after-treating agent to render direct colors fast to washing.

*Formalin.* See Formaldehyde.

*Glauber's salt.* See Sodium sulphate.

*Glycerine* ( $C_3H_5(OH)_3$ ) is a colorless liquid that is soluble in both water and alcohol. It is used chiefly in the spotting room as a solvent for coffee and chocolate stains. As a rule a 50 per cent. solution is used for spotting purposes.

*Green vitriol.* See Ferrous sulphate.

*Hydrochloric acid*, sometimes known as muriatic acid (HCL), is used in the cleaning and dyeing plant as a spotting agent and for scouring purposes after wet cleaning, although acetic acid is more frequently used for this latter purpose. In the dye-house it is used principally as a diazotizing agent for cotton colors. Sulphuric acid is also used for this latter purpose. The acid is volatile and should be kept in tightly closed containers.

*Hydrogen peroxide* ( $H_2O_2$ ) is a bleach and has come into extensive use among cleaners and dyers during the past several years. It is easy and simple to use, and exerts no injurious action on the fiber. The process consists in placing peroxide in water and adding enough ammonia to make the bath slightly alkaline. The goods are entered and allowed to bleach until the desired degree of whiteness is obtained. The chemical is also used as a bleach spotter to remove

dye, grass, blood, fruit, wine, and other stains from garments.

*Hydrosulphite* is a stripper used to remove colors from fabrics. It is on the market under a variety of names. It is used with the addition of acetic acid in equal proportions. The goods are boiled until the color has disappeared.

*Magnesium sulphate* ( $\text{MgSO}_4 + 7 \text{H}_2\text{O}$ ) is an after-treating agent. Its use is confined to after-treating sulphur colors, and consequently is not extensively used in the cleaning plant.

*Meta phenylene diamine* ( $\text{C}_6\text{H}_4(\text{NH}_2)_2$ ) is a developer. It comes in the form of either a dark grayish powder or crystals. It is used in the same manner and produces the same results as Meta Toluylene described below.

*Meta toluylene diamine* ( $\text{C}_6\text{H}_3\text{CH}_3(\text{NH}_2)_2$ ) is used in the dye-house as a developer, principally for dark shades and black. It comes in the form of brownish crystals and is dissolved by boiling with twice its weight of soda ash.

*Methyl alcohol* ( $\text{C}_3\text{H}_5\text{OH}$ ) is used as a solvent for certain dyestuffs.

*Muriatic acid.* See Hydrochloric acid.

*Naphthol B* is a developer used principally for developing blue, red, brown, and some black dyes. It is a white powder insoluble in water. It is dissolved by boiling with one-half its weight of caustic soda.

*Oil of vitriol.* See Sulphuric acid.

*Oxalic acid* ( $\text{C}_2\text{H}_2\text{O}_4 + 2 \text{H}_2\text{O}$ ) is used by the cleaner chiefly for the removal of iron and rust stains. A



weak, warm solution is applied to the spot, allowed to stand for a short time, and is then rinsed out with warm water.

*Perborate of soda* is a bleaching agent that is very similar to peroxide of soda. Perborate of soda finds its principal use in the cleaning plant as a spotting agent for the removal of perspiration stains.

*Permanganate*. See Permanganate of potash.

*Permanganate of potash* ( $\text{KMnO}_4$ ) is a bleaching agent. It comes in the form of dark crystals which dissolve readily in water, forming a violet solution. The goods to be bleached are soaked in a solution of the permanganate, rinsed, and given a bath in bisulphite of soda. There is always danger of damaging the goods when permanganate is used as a bleaching agent, and this fact has caused cleaners to discontinue its use to a considerable extent and to use other bleaching agents that are not open to this objection.

*Peroxide of hydrogen*. See Hydrogen peroxide.

*Phenol, or carbolic acid* ( $\text{C}_6\text{H}_5\text{OH}$ ) is used in the dye-house as a developer. It comes on the market in crystalline form and is readily soluble in water. Its principal use is for developing light green shades.

*Potassium acid tartrate*. See Tartar emetic.

*Potassium aluminium sulphate*. See Alum.

*Potassium bichromate, chrome* ( $\text{K}_2\text{Cr}_2\text{O}_7$ ), a mordant for wool, is on the market in the form of orange-colored crystals. The wool is boiled in a solution of the chemical, which action deposits an oxide of chrome on the fiber. This oxide is then reduced with lactic acid in the mordanting bath, in which state it readily

combines with the color being dyed. A cold process of mordanting is also carried out by the use of bisulphite in combination with bichromate.

*Potassium bitartrate.* See Cream of tartar.

*Potassium carbonate* ( $\text{KCO}_3$ ) is an alkali that possesses the same properties and is used for the same purposes as sodium carbonate. However, it is milder in its action. See Sodium carbonate.

*Resorcine* ( $\text{C}_6\text{H}_6\text{O}_2$ ). A developer used in the dye-house for developing orange and brown shades. It comes in the form of colorless crystals that are soluble in water.

*Sal soda.* See Soda ash.

*Soda ash* ( $\text{Na}_2\text{CO}_3$ ) and *sal soda* ( $\text{Na}_2\text{CO}_3 + 10 \text{H}_2\text{O}$ ). The first of these chemicals comes in the form of a white powder, and the second in the form of white crystals. One hundred pounds of soda ash are equivalent to 270 lbs. of sal soda. They are used in the cleaning plant as an addition to the scouring water used for cleaning wool, and in the dye-house for dyeing logwood on union goods. They are also used to give a mild strip to cotton goods.

*Sodium acetate* ( $\text{NaC}_2\text{H}_3\text{O}_2$ ) comes in white crystalline form and is soluble in water. It is used in the dye-house as a dyeing assistant for Azo colors.

*Sodium biborate.* See Borax.

*Sodium bichromate* ( $\text{Na}_2\text{Cr}_2\text{O}_7 + 2 \text{H}_2\text{O}$ ) is used in the dye-house as a developing agent for after-chrome colors, also as an after-treating agent to increase the fastness to washing of direct colors. This chemical comes in the form of small yellowish crystals which

dissolve readily in water. The container in which the chemical is kept should remain well covered.

*Sodium bisulphate* ( $\text{NaHSO}_4$ ). This is a dyeing assistant. It comes in the form of a white crystalline mass. It is used as a substitute for Glauber's salt and sulphuric acid in wool dyeing. Ten parts of this chemical equal 4 parts of sulphuric acid and 10 parts of Glauber's salt.

*Sodium bisulphite*. See Bisulphite of soda.

*Sodium chloride, common salt* ( $\text{NaCl}$ ), used in dyeing in place of Glauber's salt, and for setting the colors on cotton goods before wet cleaning.

*Sodium hypochlorite* ( $\text{NaOCl}_2$ ). A bleaching agent produced by the addition of soda ash solution to a solution of chloride of lime. The exact method of making and use of it are explained on another page of this book.

*Sodium perborate*. See Perborate of sodium.

*Sodium peroxide* ( $\text{Na}_2\text{SO}_2$ ). A bleaching agent used for bleaching wool, silk, cotton, jute, feathers, and, in fact, all fibers. It comes in the form of a white powder, and to prevent loss of strength it should be stored in a dry place and kept well covered. It is one of the safest bleaching agents to use in the cleaning plant.

*Sodium phosphate* ( $\text{Na}_2\text{HPO}_4 + 12 \text{ H}_2\text{O}$ ) comes in the form of a white powder. Its uses are confined to the dye-house, where it is used during the process of dyeing unions to keep all of the color from going onto the wool, and when dyeing certain colors of the direct class to assist in the production of clear shades. It is

also used to a considerable extent for softening water and for use in peroxide baths to correct any iron that might be present.

*Sodium silicate, water glass* ( $\text{Na}_2\text{Si}_4\text{O}_9$ ), may be used in the cleaning and dyeing plant whenever and wherever a mild alkali is desired.

*Sodium sulphate* ( $\text{Na}_2\text{SO}_4 + 10 \text{H}_2\text{O}$ ) comes either in the form of a white powder or crystals soluble in water. It is a dyeing assistant and is used to retard the color when dyeing acid colors on wool and thus produce even shades. When dyeing direct colors on wool or cotton the chemical is used to force the dye-stuff on the fiber.

*Sulphuric acid, oil of vitriol* ( $\text{H}_2\text{SO}_4$ ) finds its use principally in the dye-house. It is a heavy liquid and is strongly corrosive. It is used when dyeing acid colors on wool and silk, and with peroxide of hydrogen when bleaching. It is also used to destroy the vegetable matter in a fabric when testing to determine the percentages of wool and cotton present.

*Tannic acid* ( $\text{C}_{14}\text{H}_{10}\text{O}_9 + 2 \text{H}_2\text{O}$ ) is used chiefly in the dye-house, as in resisting silk to prepare the fiber to resist a further absorption of the dye. In appearance it is a light-colored powder. It is also used for mordanting cotton.

*Water glass.* See Sodium silicate.

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*Determining weighted matter on silk.* Adulterated and weighted silk often caused much trouble for the cleaner and dyer; in fact, due to the practice of manu-

facturers in weighting silk fabrics, very few cleaners and dyers will accept silk garments for cleaning and dyeing except at the customer's risk. The following methods may be followed to determine whether or not a piece of silk has been weighted and the material added to produce the weight:

If the suspected silk is dyed with a light color the presence of weighting may be detected by dyeing the suspected silk with alizarine in a container with a piece of unweighted silk and then soaping it. If no weighting is present the silk will be but lightly colored. If tin is present it will be pink, and if aluminium is present the sample will be red.

A different procedure must be followed if the suspected fabric has been dyed with dark colors. Burn a sample of the silk and dissolve the ash in hydrochloric acid. Divide this acid solution of the ash into three parts. To one add a small amount of hydro-sulphurous acid. A dark-yellow precipitate indicates the presence of tin. To another add ammonia until the acid is neutralized. A white, flaky precipitate indicates the presence of alumina. To the third add a few drops of concentrated nitric acid followed by a few drops of ferrocyanide solution. A blue precipitate indicates the presence of iron.

*Classifying a dyestuff.* To find the group in which a dyestuff belongs, according to the *Color Trade Journal*, the following procedure may be followed:

1. A small quantity of the dyestuff is dissolved in some hot water and a piece of scoured cotton is steeped in this solution. If the cotton is dyed very poorly,

or not at all, the dyestuff may belong to the basic, acid, or mordant class. If the cotton is dyed, but the color is easily removed by washing in warm soap and water, the dyestuff may belong to either the acid or the basic group. If the cotton becomes well dyed and the color is not removed by subsequent washing with soap and water the dyestuff belongs to the direct cotton group.

2. A sample of the cotton is mordanted by steeping in a solution of tannic acid, squeezed and then soaked in a cold, dilute solution of tartar emetic. This prepared sample is then dyed with the dyestuff solution as before. If the cotton is only slightly tinted or not colored at all the dyestuff belongs to the acid or mordant class. If the color is not removed by subsequent washing the dyestuff belongs to the basic class.

3. A piece of clean, scoured wool is boiled in the dyestuff solution, to which is added a few drops of sulphuric acid. If the wool is not dyed, or if the color is easily removed by subsequent washing, the dyestuff belongs to the basic or mordant class. If the wool is well dyed and the color is not removed by subsequent washing, the dyestuff belongs to the acid group.

4. A sample of wool which has been boiled with a dilute solution of sodium bichromate and sulphuric acid is dyed with a solution of the dyestuff, with the addition of a few drops of acetic acid. If the wool becomes well dyed, the dye in question belongs to the mordant class.

These tests are to be made in the order given until the proper grouping of the dyestuff is shown. The scheme given is only for the four common groups of dyes—direct, acid, basic, and mordant. In case the dye is a sulphur color or a vat dye, further chemical tests will have to be applied.

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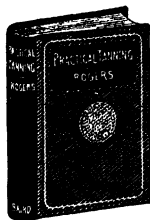
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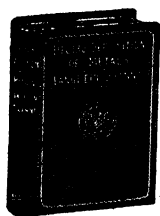
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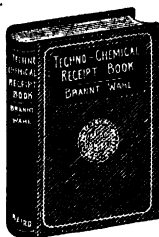
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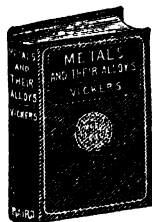
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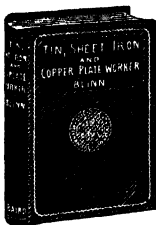
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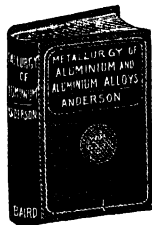
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